Johns Hopkins University

GUIDE FOR LEVERAGING CROWDFUNDING TO BRIDGE SCIENTIFIC RESEARCH RESOURCE GAPS IN DEVELOPING COUNTRIES: DESCRIPTIVE INSIGHTS, PROSPECTS, AND CHALLENGES FROM SELECTED AFRICAN COUNTRIES

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Abstract

Crowdfunding is emerging as a potentially viable alternative financial resource mobilization approach for financing scientific research. The World Bank estimates that by 2025 the crowdfunding potential for only Sub-Saharan Africa will be $2.5 billion. Exploring the enormous potential of crowdfunding in financing and enhancing scientific research in Africa is critical.

Africa countries are struggling with poverty and pandemics. A few African countries have developed to Middle-Income Country status. Insufficient funding, training amenities, and skilled scientific research personnel are major barricades to the development of science and technology in Africa. Investing in research is critical to advancing the African Union's 2063 Agenda and achieving the Sustainable Development Goals. Leveraging crowdfunding will address research barriers in Africa that have resulted in the continent merely contributing 1-2% to global research initiatives.

This Capstone Project enhances the theoretical understanding of crowd financing for scientific research in Africa and other developing countries, identifies crowdfunding bottlenecks and best practices.

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Crowdfunding Handbook for Research Administrators and other Scientific Research Stakeholders.

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Glossary

Crowdfunding. Is typically an internet-enabled process that involves requesting small amounts of funds from a substantial number of individuals or institutions to support a particular cause.[1]

Leverage. Refers to the ability to take advantage of and/or influence situations or people to determine outcomes.

Scientific Investigation Stakeholders. Refers to individuals and institutions with interest in research initiatives. It includes actors like investigators, research administrators, and all those who might be impacted by research outcomes.

Scientific Research. Is the systematic approach deployed by scientists to address global issues by critically investigating proposed/hypothetical ideas regarding the supposed relationship between observed occurrences/circumstances. It is the systematic approach undertaken by scientists to address world problems.

[1] Mokter Hossain and Gospel Onyema Operaocha, "Crowdfunding: Motives, Definitions, Typology and Ethical Challenges," *Entrepreneurship Research Journal*, 7, no.2, (December 2016). https://doi.org/10.1515/erj-2015-0045.

Abbreviations

AU	African Union.[2]
IHE	Institutions of Higher Education.[3]
HIC	High-Income Countries.[4]
IT	Information Technology.[5]
RAs	Research Administrators.[6]
SDGs	Sustainable Development Goals.[7]
SMEs	Small and Medium Enterprise.[8]
STEM	Science, Technology, Engineering, and Math.[9]

[2] The AU is a continental body composed of 55 member states on the African Continent that seeks to accelerate continental integration that will enable Africa to undertake its responsibilities in the global economy as it addresses multifaceted social, economic, and political problems. The AU, which was officially launched in 2002, was created by African Heads of State and Government.
[3] IHE as used in this Capstone Project refers to different universities, colleges, graduate schools, and any other programs undertaking scientific research in different parts of the world.
[4] HICs refers to economies that had a Gross National Income (GNI) per capita of $12,535 or more by July 1st 2020, as calculated by the World Bank Atlas method
[5] IT generally involves leveraging technology, particularly computers, and telecommunications to develop, maintain, and use of computer systems, software, and networks to process and distribute of data and also to store, retrieve, and send information and for the purpose of this Capstone Project funds.
[6] RAs refers to the women and men who undertake supportive roles to enable research scientists and research institutions to realize their scientific research goals by, among others; maintaining controls regarding the allocation and use of relatively scarce organizational resources, by acting as focal persons for scientist's as they deal with various bureaucratic processes and also generally guide processes that seek to address basic challenges
[7] SDGs refers to the global 2030 Agenda for Sustainable Development that includes 17 aspirations, commonly referred to as Sustainable Development Goals (SDGs) adopted by the UN General Assembly in 2015.
[8] SMEs refers to businesses whose revenues, assets, or personnel fall below a certain limit, and these generally vary among countries
[9] STEM is a term broadly used to group four specific disciplines; science, technology, engineering, and mathematics, among others, education policy and curriculum development stakeholders.

Chapter 1. Introduction

1.1. Background.

Insufficient scientific research practices and output have been identified as a major growth, development, and health advancement inhibition on the African continent.[10] Inadequate funding has also been highlighted as one of the key barriers to advancing research in Africa.[11] Crowdfunding, an evolving, dynamic, and viable resource mobilization approach,[12] can be an alternative funding source to facilitate mobilization of relevant, scarce, and increasingly competitive scientific research programming resources in Africa and other developing countries. This approach that originated in developing countries is increasingly availing new funding opportunities and has great potential for fostering progress.[13]

Research Administrators (RAs) and other stakeholders who support faculty to mobilize scarce and competitive investigative research financial resources require adequate knowledge on available crowdfunding prospects that should be leveraged to boost critical scientific research undertakings in Africa and other underdeveloped countries. The approach can enable scientific investigators to source funding from a larger, diverse, and unbiased audience, willing to support small, large, or risky research projects. The need to understand underlying crowdfunding intricacies, existing challenges and opportunities is therefore essential. This Capstone Project provides requisite

[10] Lem Ngongalah, et al., "Research challenges in Africa – an exploratory study on the experiences and opinions of African researchers," *bioRxiv, (October 2018): 2.* https://doi.org/10.1101/446328
[11] Ibid
[12] Ethan R. Mollick, "The Dynamics of Crowdfunding: An Exploratory Study" *Journal of Business Venturing*, 29, no.1 (January 2014): 1-16. http://dx.doi.org/10.1016/j.jbusvent.2013.06.005
[13] Habib Jamal, Sherwood Neiss, *Crowdfunding's Potential for the Developing World*, (Washington D.C.: info Dev/The World Bank, (2013): 8-12. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.

guidance that enables scientific research stakeholders to effectively mobilize funds for targeted interventions in Africa and other developing countries by leveraging crowdfunding.

1.2. Statement of the Problem.

For many years, Africa has been portrayed as a dark continent characterized by a wide range of underdevelopment indicators. The continent is grappling with a double burden of chronic and infectious diseases, compared to other regions in the world, with Sub-Saharan African men and women accounting for at least 69% of the deaths in the region.[14] Africa also remains generally underdeveloped, with a few countries having attained Middle-Income Country (MIC) status. However, the continent has made substantial progress with support from governments and the international development community in its response to some of the major global challenges, such as eliminating river blindness[15] and reducing guinea worm disease cases.[16] It has also progressed in preventing childhood illnesses like Polio,[17] and in 37 African countries, over 60% of their children have received measles' immunization.[18] Despite this, almost all African countries are still grappling with poverty, inadequate infrastructure, poor governance,

[14]Ama D. Aikins, et al., "*Tackling Africa's chronic disease burden: from the local to the global*," *Global Health*, 6, no. 5, (April 2010): 1-2. file:///C:/Users/lmutesi1/Downloads/1744-8603-6-5.pdf

[15] Kevin L. Winthrop, et al., "River blindness: An old disease on the brink of elimination and control," *Journal of Global Infectious Diseases*, 3, no. 2, (May 2011):1-4. https://www.jgid.org/article.asp?issn=0974-777X;year=2011;volume=3;issue=2;spage=151;epage=155;aulast=.

[16] Tiaji Salaam-Blyther, *Progress in Combating Neglected Tropical Diseases (NTDs): U.S. and Global Efforts from FY2006 to FY2013*, Congressional Research Service, January 2013, Cong Rep. 2-7

[17] Jean-Marie Okwo-Bele, et al., "Overview of Poliomyelitis in the African Region and Current Regional Plan of Action," *Oxford Journals; Oxford University Press*, 175, no. 1, (February 1997): s10. https://www.jstor.org/stable/pdf/30129463.pdf?refreqid=excelsior%3A2bd84d1b8c4ad343a2edd363f4d8ff78.

[18] World Health Organization, *The Health of the People: What works – The Africa Regional Health Report*, World Health Organization, Regional Office for Africa, (2014): 39-47. http://extranet.who.int/iris/restricted/bitstream/handle/10665/137377/9789290232612.pdf;jsessionid=B1CA3879BDB5A02BDD8389B46B1116D0?sequence=4.

malnutrition, conflict, and disparities in the delivery of health, education, and other essential services.

The continent has not generally remained poor and underdeveloped due to lack of resources but multiple factors. Critical challenges to Africa's science and technology developmental aspirations include poor and unsteady funding, brain drain, inadequate infrastructure, inadequate literacy levels, and a shortage of skills among men and women in scientific research.[19] Research barriers on the continent include lack of funding, insufficient training facilities, inadequate research motivation, and African research priorities being determined by overseas funding organizations.[20] As a result, the continent merely contributes 1-2% to the global research output and continues to grapple with various challenges that can be addressed through vigorous and efficient research undertakings[21]. Addressing research funding barriers on the continent is, therefore, paramount.

There are currently prospects for undertaking academic research and research training to improve the continents' research capacity. However, efforts to provide research equipment, enhance funding, promote investigative collaborations, facilitate research uptake, provide guidance, and motivations for research that are equally relevant, remain peripheral.[22]Several African presidents have appreciated and underscored the need to enhance and link local knowledge generation to development initiatives.[23]

[19] Boladale Adebowale A., et al., "Introduction," *Taylor and Francis Group*, 6:5, no. xi, (February 2015): ix-x. https://doi.org/10.1080/20421338.2015.1010774.
[20] Lem Ngongalah, et al., "Research challenges in Africa – an exploratory study on the experiences and opinions of African researchers," *BioRxiv*, (October 2018): 1.0, 3.3, 3.1.4 – 3.2.3. https://doi.org/10.1101/446328.
[21] Ibid
[22] Lem Ngongalah, et al., "Tackling the research capacity challenge in Africa: An overview of African-led approaches to strengthen research capacity,"*BioRxiv*, (January 2019). https://doi.org/10.1101/518498.
[23] Claudia Frittelli, "African Universities Advancing Research," *NCURA,* XLIX,no.2, (March/April 2017): 32-34

Whereas most African-led and Africa-based organizations have got researchers and academic programs, they hardly target funders and the general public.

Information Technology (IT) advancements have dramatically facilitated scientific research changes, including resource mobilization resulting from increased numbers of collaborations and interconnected investigative approaches involving scientists and the general public. Consequently, successful crowdfunding initiatives for scientific research are increasing and attest to the public's willingness to support and participate in investigative research undertakings. Research universities in the developed world have started using crowdfunding to support technological undertakings, especially in clean technology, medical devices, and life sciences.[24] The initiative is quickly expanding and demonstrates the viability of tapping into non-traditional funding sources to enhance investigative research undertakings.[25] However, crowdfunding largely remains a developed country phenomenon, yet its potential in Africa and other developing countries could be significant in driving innovation, growth, and job creation.[26] The need to develop a Crowdfunding Guide for RAs and other stakeholders planning to undertake investigative research undertakings in Africa and other developing countries to propel the realization of Sustainable Development Goals (SDGs) by 2040 is crucial.

[24] Habib Jamal, Sherwood Neiss, *Crowdfunding's Potential for the Developing World*, (Washington D.C.: *info Dev/The World Bank*, 2013): 9,14, 15-26, 31, 74-75. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.

1.3. Project Questions.

This Capstone Project answers the following questions:

1. What scientific research crowdfunding insights should Research Administrators (RAs) and other investigative research stakeholders targeting Africa know?
2. What crowdfunding challenges should be addressed to raise adequate scientific research resources in Africa?
3. Is crowdfunding viable for scientific research undertakings in Africa?
4. Are there successful crowdfunding practices that could be adopted and successfully applied to enhance Africa's scientific research undertakings?
5. What measures should be in place to enhance people-powered scientific research in Africa?

1.4. Project Objectives.

General Objective: This project is designed to develop an effective Crowdfunding Guideline Manual for scientific research stakeholders targeting Africa and specifically seeks to:

1. Contribute to the theoretical understanding of crowdfunding for scientific research initiatives in Africa and other developing countries with similar contexts.
2. Highlight crowdfunding challenges that need to be addressed in the quest to raise adequate scientific research resources in Africa and other developing countries.
3. Identify best crowdfunding practices that can be adopted and successfully applied to enhance scientific research in Africa and other developing countries.

4. Generate recommendations that will enhance the promotion of people-powered scientific research in Africa and other developing countries.

1.5. Significance.

This Capstone Project will enhance RAs and other scientific research stakeholders' ability to raise critical scientific research resources for investigative deliberations in Africa and other developing countries. This Capstone Project will be of great benefit to Institutions of Higher Education (IHE) and other research institutions. It will enhance the effectiveness of investigators, RAs, and other essential staff to raise critical investigative research funding for project undertakings in Africa and other underdeveloped counties. It will also serve as a crowdfunding tutorial guide in IHE.

1.6. Exclusions and Limitations.

This Capstone Project is designed to develop a feasible Crowdfunding Guideline Manual for scientific investigation stakeholders in Africa and other developing countries. It is, therefore, not meant for a particular institution or country. It is also pertinent to recognize that the universal application of this Guideline Manual across Africa and other developing countries with different legal and policy frameworks as well as diverse and evolving socio-economic, political, and security contexts may not always be tenable.

Chapter 2. Literature Review

2.1. Overview of Literature Review.

Literature reviewed points to the fact that crowdfunding is an expanding form of alternative financing that is gaining traction.[27] The literature reviewed generally looks into crowdfunding, specifically in Africa, including crowdfunding models, its potential as a funding source to enhance scientific research in Africa, crowdfunding trends, and emerging issues.

Raising funds is critical for continuing research initiatives, so taking advantage of available financial mechanisms enhances prospects of achieving the goal. While crowdfunding may not replace the traditional funding sources, it can help to address all or some of the research gaps. Crowdfunding has emerged as a relatively easy way of utilizing available networks to obtain funding for scientific interventions. The initiative (crowdfunding) is considered to possess enormous potential for university stakeholders, including students, alumni, faculty, and community members.[28]

2.2. Details of Review.

2.2.1. Crowdfunding.

Crowdfunding, also called crowd-sourced fundraising or crowd financing, "is the act of collectively raising funds by pooling together small donations from many individuals" who give to initiatives relevant to them or within their network through the

[27] Matthew J. Renwick**,** Elias Mossialos, "Crowdfunding our health: Economic risks and benefits," *Elsevier*, 191, (October 2017): 48. https://doi.org/10.1016/j.socscimed.2017.08.035.
[28] Lisa Mosley, Natasha Chopp, Patience G. Condellone, "Crowd Funding" An Enormous Opportunity at Your Fingertips," *NCURA*, (November 2015). https://www.ncura.edu/Education/OnlineEducation/Webinars/CrowdFunding.aspx.

internet.[29] Crowdfunding is the funding of projects by raising numerous small amounts of money from large numbers of individuals using virtual platforms. Therefore, crowd financing is the act of openly making funding calls by utilizing the internet as the main fundraising platform to facilitate a particular project or cause. IT has advanced the creation of innovative online meeting platforms where projects, entrepreneurs, and organizations that require funds and those that have them are facilitated to interact or crowdfund to raise resources needed to undertake particular projects. Since grant funding budgets from traditional sponsors are increasingly being reduced and proposal volumes are growing, crowdfunding is emerging as a viable alternative funding source for research and technology transfer undertakings.[30]

Crowdfunding manifests in majorly four forms or models, including donations, rewards, equity, and debt.[31][32] In their efforts to scale up the mobilization of scientific research resources, RAs and other stakeholders need to adequately appreciate some crucial facts regarding the different forms of crowdfunding. This Guideline Manual seeks to shed light on the effectiveness of each of the four crowdfunding models in raising resources required to undertake scientific research in Africa and other developing countries with similar contexts.

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[29] Natasha Chopp, Patience G. Condellone, and Jerry B. Weinberg, "Crowdfunding: Navigating the New Frontier in Research Funding and Administration," *NCURA,*XLV,no.5, (October/November 2013): 32-34

[30] Ibid

[31] Crowdfund Capital Advisors, *Crowdfunding Lessons from Developing Economies: The Importance of Ready Entrepreneurs, Enablers, and Mentors as highlighted from Clean Tech Campaigns*. Miami, Florida: Crowdfunding Capital Advisors, (2016): 14-32. http://crowdfundcapitaladvisors.com/site2015/wp-content/uploads/2016/06/Crowdfunding-Lessons-from-Developing-Economies.pdf.

[32] Ethan Mollick, "The dynamics of crowdfunding: An exploratory study, *Journal of Business Venturing, 29.no. 1, (January 2014): 1-3.* http://dx.doi.org/10.1016/j.jbusvent.2013.06.005.

2.2.2. Loan-Based Crowdfunding Model.

Loan-based crowdfunding, also called lending-based crowdfunding or debt crowdfunding, is where peer-to-peer businesses provide (lend) mostly unsecured loans to individuals, institutions, and businesses with a trading history, and majorly target Small and Medium Enterprises (SMEs).[33]Unsecured loans do not require collateral from borrowers, but transactional fees and interest on loans charged by online intermediaries depending on the borrowers' credit risk, which is determined by credit information accessed from third parties or based on information submitted by borrowers themselves.[34]Online loan-based platforms usually develop credit models to facilitate loan approvals, pricing, and credit checks for borrowers.[35]

The lending-based crowdfunding model thus leverages online platforms to match lenders with borrowers who may include individuals, businesses, and other entities to enable them access loans. Lenders usually obtain fixed-interest debts and require principal repayment based on mutually agreed upon schedules. Loan-based crowdfunding platforms may be preferred by entrepreneurs who do not wish to sell a stake in their business or projects. Unlike other crowdfunding forms where contributions may be based on social motivations or emotional attachments, investors expect a financial return from their contributions under the loan-based crowdfunding model.[36]

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[33] Kieran Garvey, et al., *Crowdfunding in East Africa: Regulation and Policy for Market Development: Reducing Poverty Through Financial Sector Development*, (Cambridge, United Kingdom: University of Cambridge, January 2017): 12-13. file:///C:/Users/lmutesi1/Desktop/Lilian/School/CAPSTON/Resources/2017-05-eastafrica-crowdfunding-report.pdf.

[34] OECD, *New Approaches to SME and Entrepreneurship Financing: Broadening the Range of Instruments*, (Paris, France: *OECD Publishing*, 2015): 23-25, 55-56. https://www.oecd.org/cfe/smes/New-Approaches-SME-full-report.pdf.

[35] Ibid

[36] Catherine Deffains-Crapsky, Agata Sudolska, "Radical Innovation and Early Stage Financing Gaps: Equity-Based Crowdfunding Challenges," *Journal of Positive Management*, 5, no. 2, (2014): 16. http://dx.doi.org/10.12775/JPM.2014.009.

2.2.3. Equity-Based Crowdfunding Model.

Equity-based crowdfunding, also called investment crowdfunding, crowd-investing, or crowd equity, is a financing mechanism through which entrepreneurs use online platforms to openly call for funding in efforts geared towards attracting large groups of investors.[37] Online platforms provide relevant transactional means, including legal necessities, pre-selection processes, and the capability to process financial transactions, among others.[38] Under equity crowdfunding, funders receive shares (equity) from profits made by the project or some form of recognition, which could be in the form of a service that could, among others, include an end product or a sales price discount.[39] Project authors and the partner crowdfunding platform define the period within which the target should be reached and the funding threshold that is then divided into equal shares and offered as equity shares.[40] As soon as the threshold is realized, the investment occurs.[41]

2.2.4. Donation-Based Crowdfunding Model.

Donation-based crowdfunding is where funds are donated by contributors, with charities and non-profit organizations constituting the major beneficiaries, although profit-based organizations can also benefit.[42] Donation-based crowdfunding targets backers (donors) who are given receipts for taxation purposes and do not expect

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[37] Ahlers Gerrit K.C., Douglas Cumming, Christina Günther,"Signaling in Equity Crowdfunding," *SAGE Journals*, 39. no.4 (July 2015): 955-958. https://doi.org/10.1111/etap.12157.
[38] Ibid.
[39] Otero, Paula, "Crowdfunding: A new option for funding health projects," *Archivos argentinos de pediatria*, 113, no. 2, (2015): 154. https://www.sap.org.ar/docs/publicaciones/archivosarg/2015/v113n2a10e.pdf.
[40] OECD, *New Approaches to SME and Entrepreneurship Financing: Broadening the Range of Instruments*, (Paris, France: *OECD Publishing*, 2015): 55. https://www.oecd.org/cfe/smes/New-Approaches-SME-full-report.pdf.
[41] Ibid
[42] Edwige Boum**, "**Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-based Crowdfunding Platforms,"*AfrikStart, (2016).* http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf.

ownership, rights, physical or financial benefits for contributing to the project. The model has been credited to be the most suitable for research and creative project undertakings.[43]

2.2.5. Reward-Based Crowdfunding Model.

Reward-based crowdfunding, also called sponsorship-based crowdfunding, is where platform founders offer material incentives like t-shirts, caps, or thank-you notes to funders depending on the value of their contributions, wherein larger contributors are rewarded with more prestigious incentives.[44] Under reward-based crowdfunding, financial contributors receive pre-determined rewards that could be in the form of small tokens of appreciation or different types of services such as public acknowledgment of their contributions. In contrast to the donation-based crowdfunding model, financial contributors under the reward-based crowdfunding model transfer funds in expectation of a reward. This form of resource mobilization has been identified as an attractive fundraising mechanism for creative projects such as comics, music and theatre, and generating complementary resources targeting small businesses.[45]

2.3. Applicability of the Literature Review.

The World Bank (2013) acknowledges crowdfunding, which emerged following the 2008 global financial crisis, as currently a developed world phenomenon that

[43] Natasha Chopp, Patience G. Condellone, and Jerry B. Weinberg, "Crowdfunding: Navigating the New Frontier in Research Funding and Administration," NCURA, XLV, no.5, (October/November 2013): 32-34
[44] Joe Cox, and Thang Nguyen, "Does the crowd mean business? An analysis of reward-based crowdfunding as a source of finance for start-ups and small businesses," Journal of Small Business and Enterprise Development, (November 2017): 4-16. file:///C:/Users/lmutesi1/Downloads/CoxNguyen2017Doesthecrowdmeanbusiness.pdf.
[45] Ibid

businesses and other organizations are increasingly using to raise funds in the form of donations or investments from various individuals.[46] Investigators targeting Africa and other developing countries need to leverage crowdfunding since it is one of the feasible mechanisms for raising required scientific research resources. RAs and scientific investigators need to adequately understand crowd financing processes if they are to adequately crowdfund for project undertakings that will successfully benefit Africa. Crowdfunding facilitates the collection of financial research resources. It fosters interactions with other crowdsourcing dimensions that enable research project leaders to test ideas, seek public advice and their creative contributions, and the possibility of the public promoting scientific research project undertakings. It is essential to recognize that "The power of science crowdfunding goes beyond financial rewards, as it has the potential to connect science and society in a powerful new way."[47]

However, despite its potential benefits, there are just a few scientists engaged in crowdfunding. Yet, those who do so frequently fall short of meeting their funding goals and do not meaningfully connect the public with scientific endeavors.[48] In 2013, the World Bank highlighted that individuals and innovative businesses worldwide could raise as much as $96 billion through crowdfunding.[49]A 2014 study noted that crowdfunding platforms worldwide raised US$16.2 billion, which was 167 percent higher than the amount raised in 2013 with North America, followed by Asia and Europe leading.[50]In

[46] Habib Jamal, Sherwood Neiss, Sherwood Neiss, "Crowdfunding's Potential for the Developing World," (Washington D.C.: info Dev/The World Bank, 2013), 8-12, https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World
[47] Rachel E Wheat, Yiwei Wang, Jarrett E Byrnes, Jai Ranganathan, "Raising Money for Scientific Research Through Crowdfunding," *Trends in ecology & evolution, 28, no.2, (February 2013),* *https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1037.1424&rep=rep1&type=pdf*
[48] Ibid
[49] Habib Jamal, Sherwood Neiss, Sherwood Neiss, *Crowdfunding's Potential for the Developing World*, (Washington D.C.: info Dev/The World Bank, 2013): 10. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.
[50] Stéphane Onnée and Sophie Renault, "Crowdfunding: principles, trends and issues" *ResearchGage*, 13, no.5, (September 2016): 313. https://www.researchgate.net/publication/308110904.

2015, the global crowdfunding market had increased further to $34.4 billion.[51]However, in the same year (2015), crowdfunding platforms based in Africa raised only about $32.3 million. The World Bank estimates that Sub-Saharan Africa's crowdfunding market potential will be $2.5 billion by 2025.[52] Scientific research stakeholders targeting Africa, therefore, need to appreciate the growing potential of crowdfunding as an alternate resource mobilization mechanism and the need to energetically harness and tap into it. The importance of RAs and other relevant scientific research stakeholders to sufficiently understand the modus-operandi of various crowdfunding models, their evolving strengths and weaknesses in enhancing or curtailing scientific investigations on the African continent and other countries with similar contexts and needs, is critical. In 2015, platforms operating on the African crowdfunding market included at least 21 donations based-platforms, 2 peer-to-peer lending crowdfunding platforms, 19 equity platforms, and 13 rewards-based portals.[53] There is need to critically analyze and appreciate why the loan-based crowdfunding model, which is mainly used by businesses and continues to grow and raise more funds compared to other crowdfunding models[54] has not gained traction in Africa. There is also a need to figure out how non-financial return lending platforms, the donation and reward crowdfunding models that constitute the bulk of the crowdfunding market activity[55] in countries like Kenya, Rwanda, Uganda, and Tanzania, can be harnessed further to enhance scientific research in Africa. It is also important to

[51] Edwige Boum, "Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms," *AfrikStart*, (2016). http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf.
[52] Ibid
[53] Ibid
[54] Stéphane Onnée and Sophie Renault, "Crowdfunding: principles, trends and issues," *ResearchGate*, 13, no.5, (September 2016): 313. https://www.researchgate.net/publication/308110904.
[55] Kieran Garvey, et al., *Crowdfunding in East Africa: Regulation and Policy for Market Development: Reducing Poverty Through Financial Sector Development*, (Cambridge, United Kingdom: University of Cambridge, January 2017), 12-13. file:///C:/Users/lmutesi1/Desktop/Lilian/School/CAPSTON/Resources/2017-05-eastafrica-crowdfunding-report.pdf.

ensure crowdfunding platforms based outside Africa, which collectively raised $94.6 million in 2015 to fund various African projects, are adequately harnessed to enhance scientific research across the continent. In addition, there is also need to draw lessons from crowdsourcing initiatives in developing countries such as the Superior Ideas crowdfunding platform that was created by Michigan Technological University that is benefiting other Science, Technology, Engineering, and Math (STEM) university research projects to inform scientific research programming in Africa.[56]

RAs and other relevant scientific research stakeholders shall be guided to appreciate whether equity-based crowdfunding, which is open only to accredited investors who pledge for equity stakes in start-up companies[57] is viable for scientific research undertakings in Africa. As the case is for loan-based crowdfunding, fund contributors under the equity-based crowdfunding model expect a financial return from their contributions. The equity-based crowdfunding model also has legal restrictions (financial regulations) that this Capstone Project will help scientific research stakeholders targeting Africa and other developing countries to appropriately consider. It also enables investigative stakeholders to examine the viability of some crowdfunding models, such as using equity platforms to raise funds for expensive investigative research undertakings in Africa that may fall short of generating useful knowledge or that will produce a product that is not attractive for the market.

The practicability of crowdfunding for critical scientific undertakings has ably been demonstrated in recent years.

[56] Natasha Chopp, Patience G. Condellone, and Jerry B. Weinberg, "Crowdfunding: Navigating the New Frontier in Research Funding and Administration," *NCURA*, XLV, no.5, October/November 2013, 32-34.
[57] Ibid

> *In the health sector, ……in terms of overall funding volume, medical crowdfunding should still be considered as a niche phenomenon, it is rapidly growing in many countries and is seen by many people as a way to cope with government cuts on public health financing.*[58]

A 2018 study revealed that USD 4,790,634 for 577 conservation-focused projects in 80 countries was raised since 2009 by proponents from universities, non-governmental organizations, and freelancers based in 38 countries using 72 crowdfunding platforms.[59] The majority of the projects were dedicated to research, which constituted 40%, while persuasion and on-ground actions constituted 31% and 21%, respectively.[60] Only a handful of those projects were, however, undertaken in African countries.[61] This underscores a number of aspects that RAs and other scientific research stakeholders need to be mindful of. For example, although crowdfunding as an alternate source of funding for scientific research is growing, relevant investigative undertakings in Africa are relatively small, confirming the need to be prioritized and scaled-up. Secondly, crowdfunding for scientific research projects targeting Africa can be undertaken by proponents using different crowdfunding platforms in other parts of the world. Thirdly, there is need to explore prospects of undertaking international collaborative scientific research and related complementary funding engagements targeting the African continent and other developing countries. Finally, there is also need to note that crowdfund sources are currently mainly from high-income economies, including the United States, Australia, and the United Kingdom, that send funds to countries with lower-income economies, including most African countries.

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[58] Gaia Bassani, Nicoletta Marinelli and Silvio Vismara, "Crowdfunding in Healthcare," *Journal of Technology Transfer*, (April 2018):1290. file:///C:/Users/lmutesi1/Downloads/Bassani2019_Article_CrowdfundingInHealthcare.pdf.
[59] Eduardo Gallo-Cajiao, et al., "Crowdfunding biodiversity conservation," *Conservation Biology*, 32, no.6 (May 2018): 2-25. https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/cobi.13144.
[60] Ibid
[61] Ibid

However, there are crowdfunding science challenges which RAs and other stakeholders also need to appreciate and address. For instance, it is relatively more difficult to crowdfund for scientific research compared to creative projects because scientific knowledge is a prerequisite for understanding healthcare campaigns.[62] There are also concerns by the research community that if nonscientists determine research funding, quality control problems are likely to arise and that vital yet complex or seemingly less attractive projects might not be adequately funded.[63]

RAs and other relevant stakeholders participating in crowdfunding initiatives should therefore be mindful of such scenarios and, in this regard, devise means of facilitating the adequate regulation of funds received, for instance, which may not be considered a priority by nonscientists, yet it could be an essential compliance requirement. The U.S.'s Federal regulation, for example, the Common Rule[64], requires institutional compliance of externally funded projects, including crowdfunded ones, particularly those involving research in human subjects and/or lab animals. Also, like traditional funders, crowdfunding sponsors may have high expectations regarding the outcomes of funded projects hence the need to ensure adequate measures are in place to appropriately monitor usage of secured funds.

[62] Ibid
[63] Lucy Bonnett, Bertha Chin, Bethan Jones, "Crowdfunding: A New Media & Society special issue," *SAGE Journals*, 17, no.2, (November 2014):1-6. https://doi.org/10.1177/1461444814558906.
[64] Department of Health & Human Services, "Federal Policy for the Protection of Human Subjects ('Common Rule'). Accessed October 26, 2020, https://www.hhs.gov/ohrp/regulations-and-policy/regulations/common-rule/index.html

Chapter 3. Needs Assessment

3.1. Needs Assessment.

Various authorities in different sectors have highlighted the need to identify alternative funding channels to complement traditional scientific research funding sources. Cameron et al.,[65]for instance, noted the need for healthcare investigative crowdfunding since research is absent on the agendas of management and finance teams. Conservationists[66] asserted the need to raise funds critical for preserving biodiversity by leveraging emerging financial mechanisms like crowdfunding to support required activities such as research.[67]

3.1.1. Assessment of Need.

A study undertaken in 2015 noted that Africa-based crowdfunding platforms raised approximately $32.3 million, which constituted below 0.1% of the global crowdfunding undertakings, with South Africa based platforms raising most of it ($30.8 million constituting 95.4%).[68.] Foreign crowdfunding platforms also provided $86.9 million for project undertakings in Africa. There is need for RAs and other scientific research stakeholders to scale up scientific research crowdfunding engagements both within and outside Africa that will enable the continent to progressively take its rightful place to contribute and utilize the World Banks' projected $2.5 Billion crowdfunded

[65] Pamela Cameron, et al., "Crowdfunding genomics and bioinformatics," *Genome biology*, 14, no 134, (September 2013):1. http://genomebiology.com/2013/14/9/134.
[66]Eduardo Gallo-Cajiao, et al., "Crowdfunding biodiversity conservation," *Conservation Bioloty*, 32, no.26, (May 2018). https://doi.org/10.1111/cobi.13144.
[67] Ibid.
[68] Edwige Boum**, "**Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms,"*AfrikStart, (2016):17, 23.* http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf.

resources by 2025. The African Union (AU)also noted that investing in science, technology, innovation, and research by 2024 is critical in advancing the AU's 2063 Agenda, contributing to the realization of the United Nations' (UN) Sustainable Development Goals (SDGs), and recommended leveraging crowdsourcing to fulfill these plans.[69]

3.2. Metrics.

Data and analytics are drawn from a critical number of relevant crowdfunding websites based on the African continent, such as Afrikstart[70] and other authorities such as the crowd financing platforms based overseas but undertake projects in Africa, for example, AlliedCrowds, were reviewed.

3.3. Sources.

Relevant online crowdfunding websites and other relevant crowdfunding literature focusing on scientific research in Africa and other relevant contexts were reviewed.

[69]African Union, *Agenda 2026: The Africa We Want, a Shared Strategic Framework for Inclusive Growth and Sustainable Development*, (Washington, D.C.: African Union, 2015): 55. https://www.un.org/en/africa/osaa/pdf/au/agenda2063-first10yearimplementation.pdf.

[70] Edwige Boum**, "**Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms,"*AfrikStart, (2016).* http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf.

Chapter 4. Project Description

4.1. Discussion of Project Elements.

Mobilizing adequate resources to conduct scientific research in Africa is critical for its developmental aspirations, including its goal to achieve SDGs. This Capstone Project sheds light on the strategic role of RAs and other international scientific research stakeholders in this regard. This is explicitly echoed in the initial African Union (AU)Heads of State and Governments' 10-year Science, Technology and Innovation Strategy for Africa (STISA-2024), that seeks to contribute towards the realization of the AU Agenda 2063; The Africa We Want, which underscores the fact that,

> *Investments in education, technical competences and training, and in science, technology, research and innovation remain critical … Mobilization of domestic excellence and financial resources and leveraging on external support and collaboration is vital for the successful implementation of STISA-2024. Strategic partnerships and collaboration … are essential for jointly solving global challenges. We have to forge strong partnerships, driven by our shared values and policy objectives and deliver impact on the ground.*[71]

STISA-2024 recognizes that, although there are conventional funding mechanisms for Research and Development (R&D) and Innovation, it is equally important to establish other efficient, effective, and harmonized financing mechanisms to implement the strategy.[72] The First Ten Year Implementation Plan of Agenda 2063 for the period2014-2023, which was the first of five-decade-long succession plans that will be developed over the fifty-year

[71] African Union Commission, *Science, Technology and Innovation Strategy for Africa 2024,* (Addis Ababa, Ethiopia, 2014). https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-stisa-english_-_final.pdf.
[72] Ibid

period, rightly highlights crowdfunding as one of the relevant financing sources that should be considered.[73]

Scientific research priority areas required in Africa have also been identified.STISA-2024 states that,

> *The priority action areas have been identified and validated by African and International Research and Innovation Stakeholders from different sectors such as Agriculture and Food Security, Biosciences, Governance and African Integration, Information and Communication Technologies (ICT), Natural Resources, Public Health, and Human Studies – to provide the necessary foundation to achieve a sustainable African Renaissance. It is envisaged that the collaborative and coordinated implementation of the identified priority areas … is a prerequisite to building an integrated and prosperous Africa, where citizens are assured of equal access to quality nutrition, healthcare and education and skills training, efficient and cost-effective communications, peace and security, and sustainable management of natural resources and environments to secure the interests of future generations.*[74]

This Capstone Project, therefore, brings to the forefront, the scientific research priorities identified in Table 1. Summary of STISA-2024 Research Priority Areas, which RAs and other investigative stakeholders targeting Africa need to consider when crowdfunding.

[73] African Union Commission, *The Africa we Want: First Ten-Year Implementation Plan 2013 – 2023*. (Addis Ababa, Ethiopia, 2015): 28 -31, 102, 138 – 139. https://wedocs.unep.org/handle/20.500.11822/20823.
[74] African Union Commission, *Science, Technology and Innovation Strategy for Africa 2024,* (Addis Ababa, Ethiopia, 2014): 20-24. https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-stisa-english_-_final.pdf.

Table 1. Summary of STISA-2024 Research Priority Areas[75]

	Priorities	Research and/or innovation areas
1	Eradicate Hunger and ensure Food and Nutrition Security	- Agriculture/Agronomy in terms of cultivation technique, seeds, soil and climate - Industrial chain in terms of conservation and/or transformation and distribution infrastructure and techniques
2	Prevent and Control Diseases and ensure Well-being	- Better understanding of endemic diseases - HIV/AIDS, Malaria Hemoglobinopathie - Maternal and Child Health - Traditional Medicine
3	Communication (Physical & Intellectual Mobility)	- Physical communication in terms of land, air, river and maritime routes equipment and infrastructure and energy - Promoting local materials - Intellectual communications in terms of ICT
4	Protect our Space	- Environmental Protection including climate change studies - Biodiversity and Atmospheric Physics - Space technologies, maritime and sub-maritime exploration - Knowledge of the water cycle and river systems as well as river basin management
5	Live Together – Build the Society	- Citizenship, History and Shared values - Pan Africanism and Regional integration - Governance and Democracy, City Management, Mobility - Urban Hydrology and Hydraulics - Urban waste management
6	Create Wealth	- Education and Human Resource Development - Exploitation and management of mineral resources, forests, aquatics, marines etc - Management of water resources

In addition to Table 1. Summary of STISA-2024 Research Priority Areas, this Capstone Project provides contextually relevant insights regarding Africa and other developing countries' scientific research crowdfunding initiatives. This includes, among others, the status of crowdfunding in Africa today and other parts of the world, ideal project sizes, appropriate communication, gender, public engagement, and networking dynamics. It also provides insights on effective crowdfunding processes, scientific crowdfunding platforms, pertinent crowdfunding lessons from developed and developing countries, crowd funders' characteristics, crowdfunding regulations, advantages, and limitations of different crowdfunding models, and the place of accountability and transparency in crowdfunding.

[75] Ibid

This Capstone Project also outlines various challenges that could impede scientific research crowdfunding undertakings relevant for Africa, which RAs and other scientific investigators need to recognize and address. A review conducted by the AU,[76] for instance, highlights various challenges, including relatively peculiar ones, that RAs and other international scientific research crowdfunding stakeholders targeting Africa need to be cognizant of. The challenges include insufficient funding for programs and the fact that there are several short-term scientific project undertakings and solutions, with only a few long-terms projects, arising from over-reliance on external sources. In addition, Science, Technology and Innovation (STI) policymakers on the continent work in isolation from other policy institutions. The review also highlighted weak links across the private sector, education, and research entities in Africa. Inadequate linkages among the international and African policy research think tanks were also cited.[77]

RAs and other international scientific research stakeholders need to leverage scientific research collaborative crowdfunding initiatives to address these challenges, as they seek to bridge scientific research and technological differences between developed and developing countries. This will help increase the number of scientific researchers involved in African projects, to enhance a science tradition, diversify and improve funding and access to published science that now curtails research systems in Africa and other developing countries, and are inhibiting implementation of the 2030 SDG agenda.

This Capstone Project highlights how crowdfunding for scientific research undertakings targeting Africa can contribute towards the realization of the 17SDGs

[76] Calestous Juma, and Ismail Serageldin, *Rebooting African Development: Science, Technology and Innovation Strategy for Africa*, Harvard Kennedy School, Cambridge, MA, (2016): 5, 8, 17.
https://www.belfercenter.org/sites/default/files/files/publication/RebootingAfricaFinal.pdf.
[77] Ibid

identified by the UN Resolution A/RES/70/1. It helps RAs and scientific research stakeholders to appreciate that "Transforming our World," the 2030 Agenda, requires mobilization of global efforts. This includes the need to adopt various relevant resource mobilization sources and mechanisms in the quest to end poverty, protect the planet, promote peace, and safeguard people's rights and dignity. UN Resolution A/RES/70/1 overtly emphasizes that,

> *Governments, international organizations, the business sector and other non-State actors and individuals must contribute to changing unsustainable consumption and production patterns, including through the mobilization, from all sources, of financial and technical assistance to strengthen developing countries' scientific, technological and innovative capacities to move towards more sustainable patterns of consumption and production.*[78]

This Capstone Project also specifies SDG scientific research priorities[79]that are relevant to Africa that require crowdfunding. SDG Target 2.a. seeks to increase investments through enhanced international cooperation in agricultural research, while SDG Target 3.b. underscores the need to support research and the development of vaccines and medicines that address communicable and non-communicable diseases that mainly affect developing countries. SDG Target 7.a. aspires to enhance, by 2030, international collaborations that will enable access to clean energy, research, and technology, including energy efficiency, renewable energy, advanced and cleaner fossil-fuel technology. Target 9.5 requires enhancing scientific research and upgrading industrial sectors' technological capabilities in different countries, while 12.a. stresses the

[78] United Nation, *Transforming our World: The 2030 Agenda for Sustainable Development*, UN, (October 2015): 8-35. https://www.un.org/ga/search/viewm_doc.asp?symbol=A/RES/70/1.
[79] Ibid

need to support Africa and other developing countries' scientific and technical capacities to progress towards more sustainable consumption and production patterns.

Target 12.a. will be assessed by measuring the amount of support towards research and development for sustainable consumption, production, and environmentally sound technologies given to developing countries by various actors. This arguably includes RAs and other scientific research stakeholders. Target 14.a. seeks to increase scientific knowledge, enhance research capacity, and application of marine technology. This Capstone Project also emphasizes the fact that the UN Resolution A/RES/70/1 reaffirms the need to support the AU's Agenda 2063.

In conclusion, this Capstone Project enhances the theoretical understanding of crowdfunding for scientific research undertakings in Africa, and other developing countries with similar contexts. It also highlights crowdfunding prospects, best practices, challenges, and measures that will enhance scientific research in Africa, and other developing countries.

Chapter 5. Methodology

5.1. Methodology Overview.

This Capstone Project undertook a desk review of secondary data, focusing on document and content analysis as the key research methods used to establish the status and prospects of scientific research crowdfunding in Africa and other developing countries. Literature analyzed included examining emerging crowdfunding issues, trends, models, and other pertinent aspects from which crowdfunding insights, themes, conclusions, and recommendations were made. The literature that was systematically reviewed highlighted the strengths and weaknesses of different crowdfunding models in enhancing scientific research in Africa and other developing countries.

Relevant publications, such as the National Council of University Administrator's (NCURA's) *Magazines*,[80,81,82] and Journal of Business Venturing[83] were reviewed to support this Capstone Project and ultimately, the development of an effective and user Crowdfunding Guideline Manual that enhances the theoretical understanding of scientific research crowd financing undertakings in Africa and other developing countries. Reviewed publications also highlighted challenges, remedial measures, best practices, and key recommendations that need to be considered by RAs and other scientific research stakeholders when crowdfunding for scientific research project undertakings in Africa.

[80] Natasha Chopp, Patience G. Condellone, and Jerry B. Weinberg, "Crowdfunding: Navigating the New Frontier in Research Funding and Administration," *NCURA,* XLV,no.5, (October/November 2013): 32-34
[81] Lisa Mosley, Natasha Chopp, Patience G. Condellone, "Crowd Funding" An Enormous Opportunity at Your Fingertips," *NCURA*, (November 2015). https://www.ncura.edu/Education/OnlineEducation/Webinars/CrowdFunding.aspx.
[82] Claudia Frittelli, "African Universities Advancing Research," *NCURA,* XLIX, no. 2, (March/April 2017): 32-34.
[83] Ethan R. Mollick, "The Dynamics of Crowdfunding: An Exploratory Study" *Journal of Business Venturing*, 29, no.1 (January 2014): 1-16. http://dx.doi.org/10.1016/j.jbusvent.2013.06.005.

Authoritative documents by the World Bank,[84] Edwige,[85] among many others, clearly demonstrated the funding potential of crowdfunding as an alternative source of funding for scientific research undertakings, which RAs and other scientific research stakeholders targeting Africa and other underdeveloped countries need to embrace. They also highlighted the best performing crowdfunding recipient and funding countries, major crowdfunded projects on the African continent, and the amount of money generated by different crowdfunding models.

Information was obtained online from foreign-based crowdfunding platforms such as Kiva,[86] GlobalGiving,[87] GoFunMe.com[88] that channeled $94.6 million in 2015 to finance projects in Africa, and several other Africa-based Crowdfunding Platforms, such as Wealth Migrate[89] and AfrikStart[90] that collectively raised about $32.3 million in 2015. This, together with a review of other platforms such as Experiment.com,[91]USEED,[92] Consano,[93] and MedStart,[94] among others, helped to identify the most promising crowdfunding platforms that scientific research stakeholders targeting Africa need to consider.

[84] Habib Jamal, Sherwood Neiss, *Crowdfunding's Potential for the Developing World,* (Washington D.C.: info Dev/The World Bank, 2013): 8-75. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.
[85] Edwige Boum**, "**Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms,"*AfrikStart*, *(2016):17, 23*. http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf.
[86] Kiva. n. d. Accessed October 16, 2020. https://www.kiva.org/.
[87] Global Giving. n. d. Accessed October 16, 2020. https://www.globalgiving.org.
[88] Airfunding. n. d. Accessed October 16, 2020. https://www.airfunding.net/start?gclid=EAIaIQobChMI4uPGl6m_7AIVWODtCh2QuQEWEAAYASAAEgKSBPD_BwE.
[89] Wealthmigrate. n. d. Accessed October 16, 2020. https://wealthmigrate.com/.
[90] Crowdfunding Africa. n. d. Afrikstart. Accessed October 16, 2020. https://www.afrikstart.com/.
[91] Experiment. n. d. Accessed October 16, 2020. https://experiment.com/.
[92] USEED. n. d., "Supporting Fundraising." Accessed October 16, 2020. http://www.supportingfundraising.com/useed/.
[93] Consano. "Directly Support Medical Research that Matters to you, Consano." Accessed October 16, 2020, https://consano.org/
[94] Medstartr. n. d. Accessed October 16, 2020. https://www.medstartr.com/.

5.2. Project Design and Discussion.

This Capstone Project deployed a descriptive research design. This helped to identify answers to various research questions such as what scientific research crowdfunding insights should RAs and other investigative research stakeholders targeting Africa consider. It also enabled the understanding of different crowdfunding types, including donations, rewards, equity, debt, pertinent dynamics regarding each of them, and the strengths and weaknesses of crowdfunding in mobilizing resources required to enhance scientific research in Africa and other developing countries. The project design also highlighted the fact that crowd financing is appropriate for enterprises in the technological sector and research establishments as it aids researchers and students in various research endeavors beneficial to Africa.

The design further helped answer whether crowdfunding is viable for scientific research undertakings in Africa by highlighting the fact that donation-based crowdfunding engagements, including scientific research undertakings in many African countries, have sustainably taken root while equity-based platforms are in early development stages.[95] It also affirmed the fact that African countries have witnessed steady growth in crowdfunding undertakings over the years, as evidenced by the number of platforms that have doubled annually due to factors ranging from an increase in the middle class, rapid mobile technological adoption, and actual market demand.[96] Strong diaspora communities, improved educational systems, and early-stage entrepreneurship undertakings are also contributing to a favorable crowdfunding environment in Africa.

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[95] Habib Jamal, Sherwood Neiss, Sherwood Neiss, *Crowdfunding's Potential for the Developing World*, (Washington D.C.: info Dev/The World Bank, 2013), 10, 15, 19, 32. 33.
https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.
[96] Ibid

The design also facilitated the appropriate description of various crowdfunding platforms with expertise in science, clean energy, and climate-related campaigns, among others, that could enhance sustainable scientific research crowdfunding undertakings in Africa.

However, although crowdfunding initiatives in Africa and other underdeveloped countries have increased, the Capstone Project design also pertinently amplified the fact that most crowdfunding platforms are currently found in North America and Europe. There is, therefore, a need for RAs and other investigative stakeholders based in these regions (North America and Europe) to leverage those crowdfunding platforms in efforts designed to enhance scientific research relevant for Africa.

The research design also helped to describe various challenges that need to be addressed to enhance mobilization of scientific research resources for Africa. These include unfavorable crowdfunding cultures, regulatory challenges, inadequate electronic infrastructure, fraud risks, and the fact that crowdfunding is not necessarily the remedy for all scientific research funding challenges, and the latent risk that relatively complex technological projects may not be easily explained to crowdfunding investors.

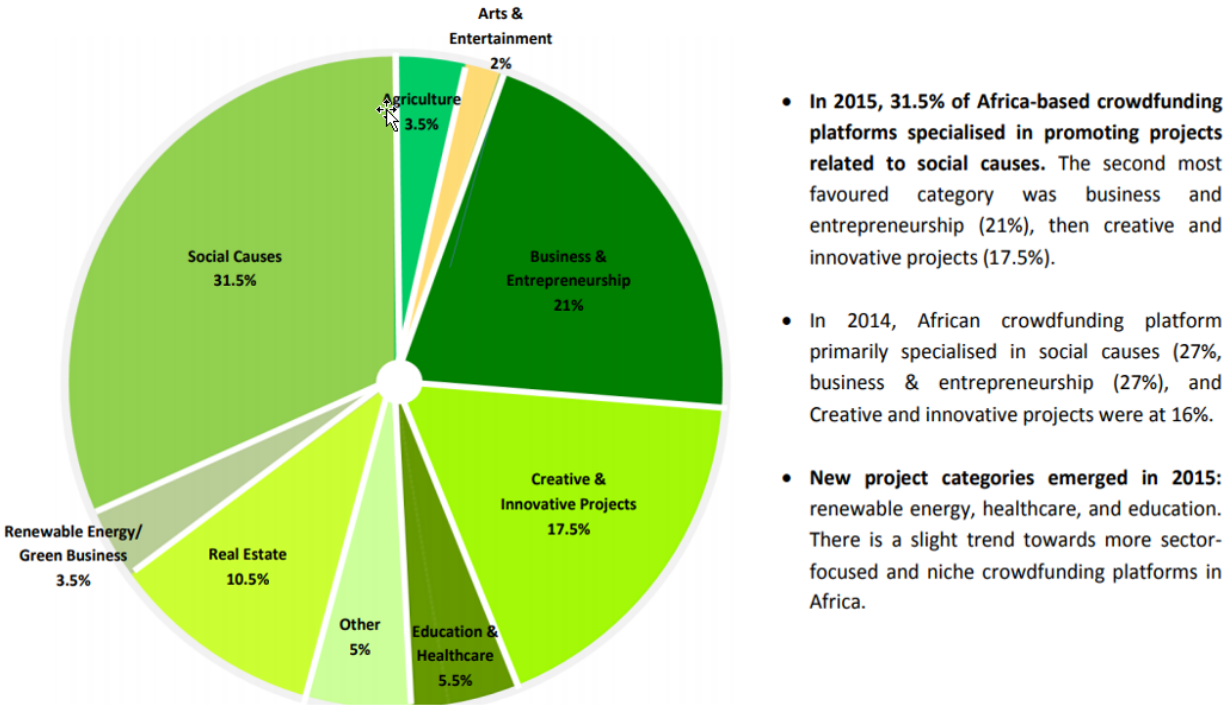
The design also facilitated the identification of best crowdfunding practices that could be replicated to enhance Africa's scientific research undertakings. Measures required to enhance people-powered investigative research, which RAs and scientific researchers targeting Africa need to consider were also highlighted. These include, among others, the need to sponsor relevant management teams to engage potential scientific research investors for project undertakings beneficial to Africa. The need to strengthen capacities of RAs and other scientific researchers targeting Africa and other developing countries to enable them to appreciate and learn best crowdfunding practices,

including reporting practices and other areas was also noted. The need to network and leverage individuals and organizations with relatively large social media influence to support crowdfunding campaigns was also highlighted. This is, in addition to the need to strategically tag crowd financing initiatives to philanthropic, cultural, and other legitimate causes; the need to create crowdfunding market coalitions; identify, document, and share best crowdfunding practices from the developed world and elsewhere; and the need to appreciate gender, local and culturally appropriate aspects in scientific crowdfunding initiatives.

Besides enabling to answer various research questions, the descriptive research design also helped to establish the status of crowdfunding undertakings earmarked for Africa that will constitute a basis for RAs and other scientific research stakeholders to plan for projects beneficial to Africa. Notably, the design highlighted that crowdfunding campaigns for social causes, followed by business and entrepreneurial initiatives, creative and innovative projects dominated Africa-based crowdfunding platforms in that order, as highlighted in Figure 1 below.[97]

[97] Edwige Boum, "Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms," *AfrikStart*, (2016). http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf 40.

Figure 1. Africa-Based Crowdfunding Projects Launched in 2015[98]

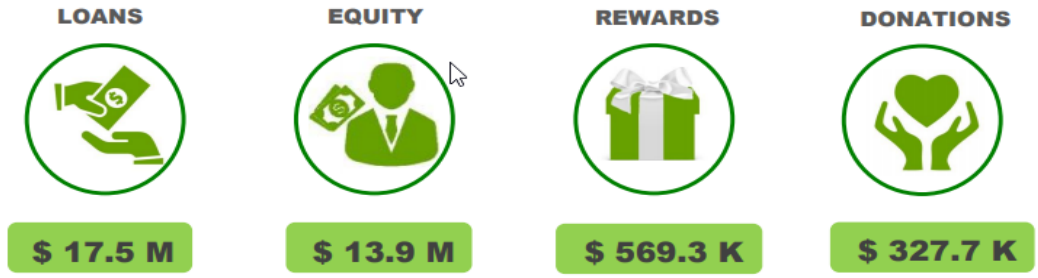


The project design also helped to establish that funds mobilized by African-based crowdfunding entities were majorly for startups and SMEs, real estate ventures, travel, social causes, and charitable undertakings. In addition, the project design also helped to highlight the fact that foreign founded and Africa-based crowdfunding podiums mainly funded social cause projects in West and East African English-speaking countries.[99]

The descriptive research design also enabled this Capstone Project to highlight that loans, followed by equity, donations, and rewards crowd financing models generated more funds from Africa-based crowdfunding platforms, as highlighted in Figure 2 below.[100]

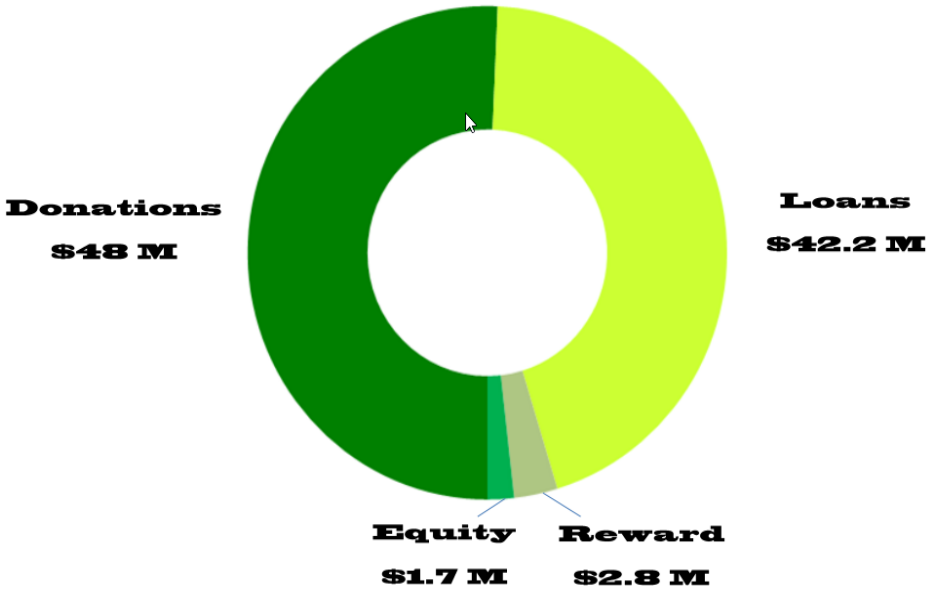
[98] Ibid
[99] Ibid
[100] Ibid

Figure 2. Money Raised by Africa-Based Crowdfunding Platform Models in 2015[101]



On the contrary, foreign-based crowdfunding platforms mobilized more funds earmarked for project undertakings in Africa using the donations crowdfunding model, which is considered more credible and viable for scientific research undertakings, followed by the loans, rewards, and equity models as highlighted in Figure 3 below.

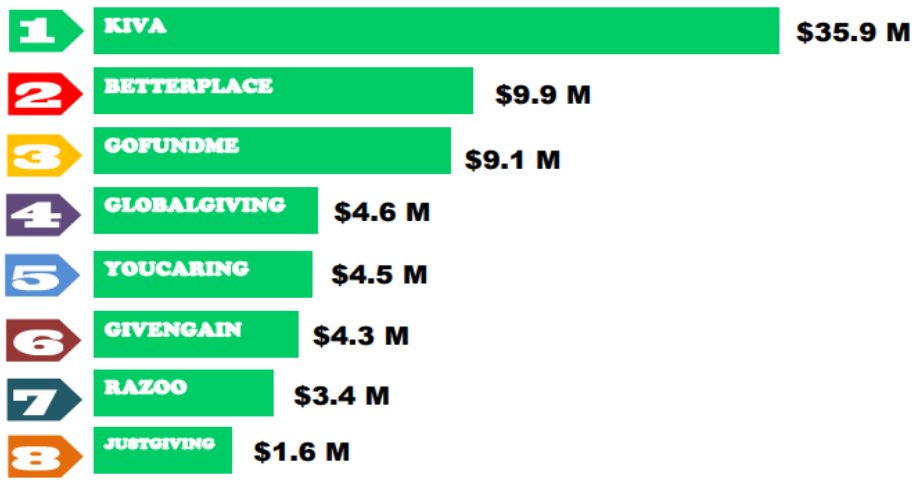
Figure 3. Money Raised by Foreign-Based Crowdfunding Platform Models in 2015[102]



[101] Ibid
[102] Ibid

The descriptive research design further facilitated this Capstone Project to highlight the major foreign-based crowdfunding platforms undertaking projects in Africa, as indicated in Figures 4 below.[103]

Figure 4. Top Foreign Platforms Operating in Africa in 2015[104]



Another key highlight is the fact that major Africa-based crowdfunding podiums, basing on the amount of funds they raise, are distinguished for being sector-focused or have a market niche such as the real estate crowd financing Wealth Migrate and Aqarfunder websites that were ranked first and second, respectively in 2015 as well as the Trevolta crowdfunding platform that specializes in travel crowdfunding which was ranked fourth.[105]Lastly, the descriptive research design also enabled this Capstone Project to identify what RAs and other scientific research stakeholders targeting Africa need to practically do when crowdfunding. Notably, the need for project developers to explore and contact influential and effective crowdfunding podiums, consider the role of

[103] Ibid
[104] Ibid
[105] Ibid

‘incubating, building networks and generating appropriate media content, consider undertaking effective communication campaigns, and the need to allocate adequate time, costs and benefits of specific crowdfunding drives.

Chapter 6. Project Results and Discussion

This Capstone Project seeks to address the challenge of inadequate funding that has contributed to inadequate scientific research practices and output in Africa by leveraging crowdfunding. It is expected that successful crowdfunding for scientific research initiatives will spur the continent's development Agenda 2063: The Africa We Want.[106]This Capstone Project sought to contribute towards enhancing the theoretical understanding of crowd financing for scientific research in Africa and other developing countries. The Project also sought to identify crowdfunding bottlenecks that need to be addressed to enhance scientific research project undertakings on the continent and in other developing countries. This Project further set out to highlight crowdfunding best practices that will bolster scientific research endeavors in developing countries. Chapter six (6) thus relays and discusses the findings of this Capstone Project in this regard.

6.1. Project Result 1. Theoretical Understanding of Crowdfunding for Scientific Research in Africa and other Developing Countries.

Crowdfunding, a viable resource mobilization approach that has generally evolved in the developed world, has, until now, enabled initiators of profitable, artistic, and cultural endeavors to fund their undertakings.[107]The initiative involves drawing on moderately small contributions from a relatively sizeable pool of individuals using the internet without going through standard financial intermediaries.[108]However, scholars

[106] African Union, *Agenda 2026: The Africa We Want, a Shared Strategic Framework for Inclusive Growth and Sustainable Development*, (Washington D.C.: *African Union*, 2015): 55. https://www.un.org/en/africa/osaa/pdf/au/agenda2063-first10yearimplementation.pdf.
[107] Ethan R. Mollick, "The Dynamics of Crowdfunding: An Exploratory Study" *Journal of Business Venturing*, 29, no.1 (January 2014): 1-16. http://dx.doi.org/10.1016/j.jbusvent.2013.06.005.
[108] Ibid

have limited knowledge of successful crowdfunding dynamics, its overall distribution, and the effective use of crowdfunding mechanisms.[109] This is particularly the case for scholars undertaking investigative research where scientists and policymakers have just started appreciating that crowdfunding offers valuable scientific research support.[110]There is need to generally enhance scientific research's crowdfunding theoretical discourse regarding the much-needed investigative undertakings in Africa and other developing countries in particular. The limited studies that have been conducted with a focus on Africa have generally been conceptual.[111]

Leveraging crowdfunding enhances mobilization of more scientific research financial resources required to augment progressively tight budgets from traditional investigative funding sources. It has been noted that: "Fundraising is also faster than in the traditional grant-based system."[112] Crowd financing will enable funding of some scientific research projects in Africa and other developing countries without resorting to traditional banking setups and the rigors involved therein. The mechanism is "suitable for smaller projects and early-stage studies without preliminary evidence."[113] Crowdfunding platforms enable investigators targeting Africa and other underdeveloped countries to identify supporters interested in the same scientific research endeavors, even when the investigations are not necessarily mainstream or not prioritized by conventional funding

[109] Ibid
[110] Henry Sauermann, Chiara Franzoni, Kourosh Shafi, "Crowdfunding scientific Research: Descriptive insights and correlates of funding success," *PLOS One*, (January, 2019):20/26. https://doi.org/10.1371/journal.pone.0208384.
[111] Emmanuel Chao, et al., "Crowdfunding in Africa: Opportunities and Challenges." *Springer*, (August 2020): 333. https://doi.org/10.1007/978-3-030-46309-0_14.
[112] Ibid
[113] Ibid

agencies. Investigators are also accorded the opportunity to receive feedback on their investigative work.

This essentially means that crowdfunding should be embraced as it facilitates testing of prospective goods, services, theories, and/or scientific research outputs in addition to enhancing mobilization of scientific research financial resources. Crowd financing leverages communities in different parts of the world to strengthen scientific research undertakings in Africa and other developing countries, including investigative areas where funding is difficult to obtain. Presentation of investigative research initiatives beneficial to Africa and other developing countries to crowd financing podiums also enables scientific researchers to promote their projects and take advantage of crowdfunding platforms' viral potential to enhance research input, output, and uptake.

In the absence of empirical evidence, pointers highlight why donation-based crowdfunding has been credited to be more suitable for research and creative project undertakings and likely to continue being more eminent, convenient, and viable for investigative undertakings in Africa and other developing countries.[114] The pointers include the fact that Africa is simply emulating market development trends observed in High-Income Countries (HICs) and other areas where preliminary crowdfunding engagements were characterized by non-investment crowd financing. Less risk concerns involved in non-investment fundraising engagements, the relatively small amounts of funds involved, and generally less regulatory adherence barricades compared to investment crowdfunding also makes this model more convenient to implement and facilitate experiments in scientific research undertakings.

[114] Emmanuel Chao, et al., "Crowdfunding in Africa: Opportunities and Challenges." *Springer*, (August, 2020): 324, https://doi.org/10.1007/978-3-030-46309-0_14

This Capstone Project established that the loan-based crowdfunding model that is increasingly being leveraged to raise funds compared to other crowdfunding models "is not reflected in current research"[115] as much as the donation-based crowdfunding model. The model's speed and safety in raising capital for businesses online and the better returns it offers compared to banks, makes it attractive to investors, companies and not necessarily investigators. There is need to undertake more investigations on the loan/debt-based crowdfunding model, particularly its implications on scientific research undertakings in Africa and other developing countries.

It is essential for RAs and other scientific research stakeholders to recognize and interact with major crowdfunding actors, including investigators seeking funds, public/crowd financiers or backers, and crowd financing intermediary podiums who/that enable research project authors and funders to enhance investigative undertakings. This facilitates constructive engagement and effective crowdfunding. Various actors have a stake in successful crowdfunding initiatives that benefit Africa and other developing countries. These include governments that seek to enhance growth and development, entrepreneurs who wish to expand financing opportunities, the general public who wish to invest, and intermediaries operating different businesses.[116]

Some of the major crowdfunding engagements that RAs and other investigative research stakeholders seeking to boost scientific research engagements in Africa and other underdeveloped countries should consider participating in include, among others,

[115] Alexa Böckel, Jacob Hörisch & Isabell Tenner, "A systematic literature review of crowdfunding and sustainability: highlighting what really matters." *Springer Link* (2020). https://doi.org/10.1007/s11301-020-00189-3.
[116] Loreta Valančienė & Sima Jegelevičiūtė, "Crowdfunding for Creating Value: Stakeholder Approach. Procedia - Social and Behavioral Sciences."156, *Elsevier*, (April, 2014): 599-604. https://doi.org/10.1016/j.sbspro.2014.11.248.

the organization of entire crowd financing processes, mobilization of funding individuals, and production of scientific ideas. Crowd roles and the efforts involved therein aimed at enhancing scientific research in Africa and other developing countries differ depending on the crowdfunding type used. These may include crowd-philanthropists who donate, crowd-investors who grant loans, and crowd-customers who pre-purchase.[117]

RAs and other investigative stakeholders need to identify crowd financing platforms that will suitably address scientific research funding needs. Committed crowd financing platforms that have a track record of successfully supporting scientific research initiatives could, for instance, be preferred to charity crowdfunding platforms. RAs and other scientific research stakeholders also need to leverage crowdfunding podiums, which are easily accessible by targeted scientific research public funders. In Africa, for instance, platforms integrated with mobile money transfers using mobile telephones, which are more prevalently used compared to credit cards, may be preferred when determining which Africa-based crowdfunding platforms should be commissioned to crowdfund scientific research projects.

It is also essential to understand trends in funding capabilities of potential scientific research funding networks in different periods of the year and in diverse parts of the world. Funding capacities depend on time and vary among and within countries. There is need to desist from launching crowdfunding campaigns when funders are less inclined to give, for instance, after spending during major holiday seasons. It is also critical for RAs and other scientific research stakeholders to pay keen attention to funding accountability and transparency while crowdfunding for investigative initiatives since

[117] Ibid

funders commit to scientific research projects with specific expectations. There is, therefore, need for RAs and other relevant investigative stakeholders to effectively account to project donors regarding the way they discharge research undertakings beneficial to Africa and other developing countries. This will enable investigators to inform backers on their actions regarding funds received. This builds crowd backers' trust and ultimately boosts scientific research fundraising.

RAs and other investigative stakeholders also need to understand the motivating factors that drive crowds to support scientific research initiatives in Africa and other developing countries. Crowd funders' motivations are majorly four and range from an interest in receiving rewards, interest in advancing causes, interest in assisting others, and the desire to identify with communities and/or innovative undertakings.[118] It has been rightly noted that,

> *The motivations of the crowdfunding backers are likely to depend on the type of platform. While the backers on lending and equity-based platforms may participate for financial reasons, backers on reward and donation-based platforms have other motivations, such as furthering social causes, helping entrepreneurs to bring innovative products to the market, receiving product rewards, being part of the community and receiving recognition from their peers…. Internet users who are mobilizing to provide funding on crowdfunding platforms are …. communities of individuals sharing a common orientation towards projects, products or services that are likely, given their expertise, to generate value.*[119]

Thus, motivations for funders using the equity-based crowdfunding platforms in Africa, for instance, maybe receiving investment returns, which may not necessarily be the case for funders under the lending, rewards, or donation-based crowdfunding

[118] Gerber, Elizabeth & Hui, Julie, "Crowdfunding: Motivations and Deterrents for Participation. ACM Transactions on Computer-Human Interaction," 34, *ACM Journals*, (December 2013). https://doi.org/10.1145/2530540.
[119] Stéphane Onnée and Sophie Renault, "Crowdfunding: principles, trends and issues" *ResearchGage*, 13, no.5, (September, 2016): 313. https://www.researchgate.net/publication/308110904.

podiums. This means investigative research undertakings bound and/or beneficial to Africa and other developing countries are likely to be funded by individuals with varying motivations. These impetuses may not necessarily be the same motivations for funding received from traditional funding mechanisms. It has also been pertinently noted that crowd financing motivational levels decrease when individuals are often sought, made to wait for long periods without receiving expected rewards[120] or scientific research results.

Understanding cultural dynamics across the globe that motivate giving, such as circumstances where individuals generously give to benefit their own communities' needs, should be adequately considered by RAs and other scientific research stakeholders planning to undertake investigative projects in Africa and other developing countries. Meanwhile, whereas it has been rightly noted that successful crowdfunding projects generally signal from the onset, their capability to be worthwhile,[121] quality indicators for scientific research crowd financing endeavors are in some cases relatively unique. This is because,

> *Conventional signals of quality–including scientists' prior publications have little relationship with funding success, suggesting that the crowd may apply different decision criteria than traditional funding agencies.*[122]

Indeed, there is also "no evidence that projects described as riskier have a lower likelihood of being funded and creators' prior publications appear to matter little for funding success."[123]

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[120] Ibid
[121] Ethan R. Mollick, "The Dynamics of Crowdfunding: An Exploratory Study" *Journal of Business Venturing*, 29, no.1 (January 2014): 1-16. http://dx.doi.org/10.1016/j.jbusvent.2013.06.005.
[122] Henrey Sauermann, Chiara Franzoni, & Kourosh Shafi, "Crowdfunding scientific research: Descriptive insights and correlates of funding success." *PLoS ONE*, 14, no. 1. (January 2019). https://doi.org/10.1371/journal.pone.0208384.
[123] Ibid

There are enormous and viable prospects for undertaking crowdfunding for scientific research in Africa and other developing countries using various dedicated investigative research crowdfunding platforms. This is because "crowdfunding of scientific research broadens access to resources for groups that have been excluded or disadvantaged in traditional funding systems."[124] A 2013 World Bank report titled, Crowdfunding's Potential for the Developing World, highlighted that up to $96 billion could be tapped and channeled towards various crowdfunded initiatives in developing economies worldwide.[125] Sub-Saharan Africa has, for instance, been estimated to have a crowdfunding market potential by 2025 of $2.5 billion by the World Bank. Crowd financing has the "potential to democratize access to donations and capital across Africa."[126]

Diversity of developmental levels, differences in institutional mechanisms, and various geographical factors, also influence crowdfunding initiatives in Africa and other developing countries. As a result, leading African economies, including Nigeria and South Africa, dominate Africa's crowdfunding industry. The two countries, together with Kenya, "jointly accounted for 74–82% of annual African crowdfunding market volumes between 2013 and 2016."[127] Countries like Uganda, whose crowdfunding ecosystem includes, among others, improved e-commerce mechanisms, have been able to raise more

[124] Ibid
[125] Habib Jamal, Sherwood Neiss, Sherwood Neiss, *Crowdfunding's Potential for the Developing World*, (Washington D.C.: *info Dev*/The World Bank, 2013): 10, 15, 19, 32, 33. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.
[126] Edwige Boum, "Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms," *AfrikStart*, (2016). http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf 40.
[127] Emmanuel Chao, et al., "Crowdfunding in Africa: Opportunities and Challenges." *Springer*, (August 2020). https://doi.org/10.1007/978-3-030-46309-0_14.

funds using rewards-based crowdfund mechanisms based in HICs.[128] Such initiatives need to be replicated across crowdfunding platforms to enhance scientific research undertakings in Africa and other developing countries. It is, however, also pertinent for RAs and other investigative research stakeholders to note that even in African countries like South Africa and Nigeria, where some scientific research endeavors have occurred, a lot of investigative work is still required.

As highlighted in Table 2 below, there are several platforms that can be leveraged to enhance scientific research in Africa, which RAs and other investigative research stakeholders need to consider. Whereas crowd financing scientific research is just evolving, the increasing volume of successfully funded projects in Africa and other parts of the world already points to the relevance of the financial support it generates.

Table 2. Examples of Dedicated Crowdfunding Platforms for Scientific Research[129]

Name	URL	Opened	Status as of January 2018
Independent platforms			
Experiment	https://www.Experiment.com	2012	Active. 1,820 projects hosted.
Petridish	http://blog.petridish.org/	2012	Closed. 32 projects hosted.
Davincicrowd	http://www.davincicrowd.com	2012	Active. 92 projects hosted.
Consano	http://www.consano.org	2013	Active. 67 projects hosted.
Donorscure	http://www.donorscure.org	2013	Active. 16 projects hosted.
Wallacea/Crowdscience	http://crowd.science	2014	Active. 36 projects hosted.
Futsci	http://futsci.com	2015	Active. 12 projects hosted.
Science Starter	http://www.sciencestarter.de	2015	Active. 122 projects hosted.
Institution-specific platforms			
Cancer Research UK	http://myprojects.cancerresearchuk.org	2008	Closed.
Georgia Institute of Technology	https://www.gatech.edu/	2013	Closed.
UCLA	http://spark.ucla.edu	2014	Active. 15 projects hosted.
Virginia Tech	http://crowdfund.vt.edu	2017	Active. 29 projects hosted.

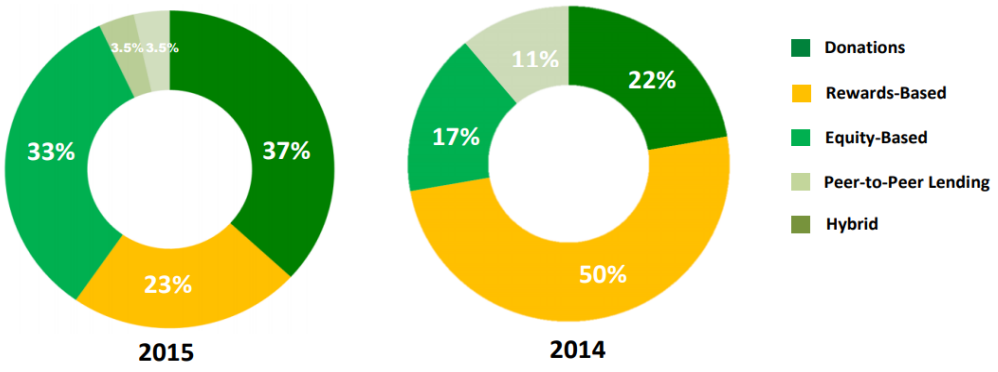
[128] Allied Crowds, "East Africa Crowdfunding Landscape Study: Producing Poverty Through Financial Sector Development," *FSDAFRICA, (October 2016).* https://www.fsdafrica.org/wp-content/uploads/2019/08/16-11-07-Crowdfunding_Report-final-1-compressed.pdf.

[129] Henrey Sauermann, Chiara Franzoni & Kourosh Shafi, "Crowdfunding scientific research: Descriptive insights and correlates of funding success." *PLOS ONE*, 14, (1). (January 2019). https://doi.org/10.1371/journal.pone.0208384.

It is important to note that none of the dedicated scientific research crowdfunding platforms highlighted in Table 2 above are among the top foreign-based crowdfunding podiums financing investigative research projects in Africa, as highlighted earlier in Figure 4 of this Capstone Project. This underscores the need for RAs and other scientific research stakeholders in HICs, and other parts of the world to vigorously tap into all existing scientific research crowdfunding platforms to enhance scientific research in Africa and other developing countries. RAs and other scientific research stakeholders need to engage some of the crowd financing platforms based in HICs to prioritize scientific research undertakings in underdeveloped countries.

Different crowdfunding models that have got the potential of enhancing scientific research undertakings in Africa and other developing countries are already being leveraged in Africa. In 2014 the most active Africa-based crowdfunding platforms were rewards-based podiums. However, as highlighted in Figure 5 below, donations and equity-based crowd financing platforms dominated the continents' crowdfunding market in 2015.

Figure 5. Africa-Based Crowdfunding Platform Models 2014 – 2015[130]



[130] Edwige Boum, "Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms," A*frikStart*, (2016). http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf.

Most of the Africa-based crowdfunding projects are based in a few countries, within which they generally fund projects with South Africa hosting a third of them, as highlighted in Figure 6 below.

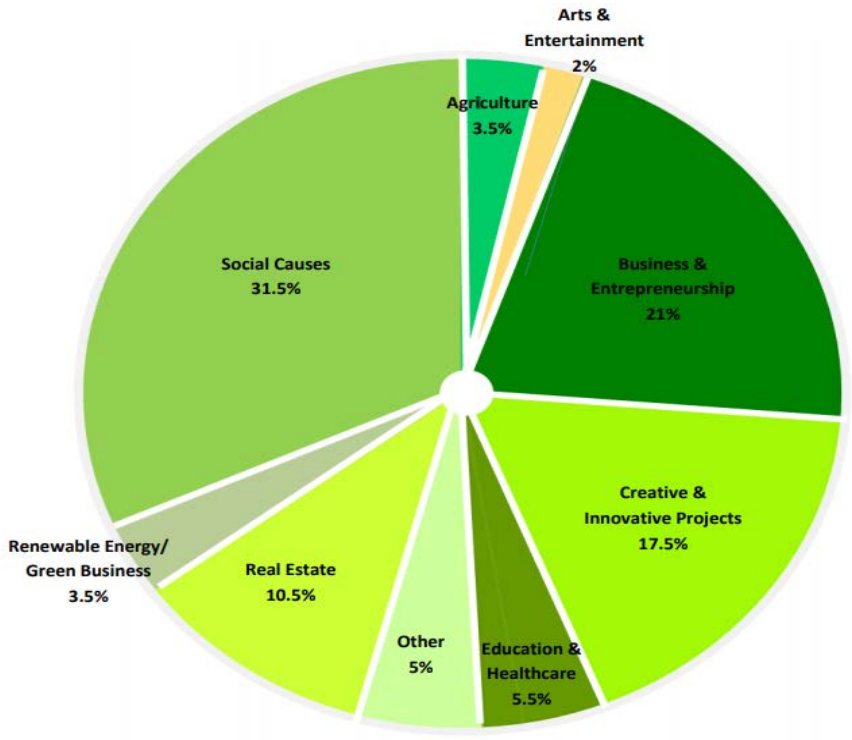
Figure 6. Geographical Distribution of Africa-Based Crowdfunding Platforms in 2015[131]

In 2014, Africa-based crowd financing podiums generally funded social causes (27%), business and entrepreneurship (27%), as well as creative and innovative projects undertakings (16%). However, in 2015 the potential and viability of crowdfunding for scientific research-related projects started to emerge in various sectors, including education, renewable energy, and healthcare, as highlighted in Figure 7 below. Although the donation-based crowdfunding model contributed most to financing scientific research

[131] Ibid

related projects (15%), as highlighted in Figure 7, other crowdfunding models (Rewards and Equity) also contributed to renewable energy and agricultural initiatives.

Figure 7. Successful Projects Launched by Africa-Based Crowdfunding Platforms in 2015[132]

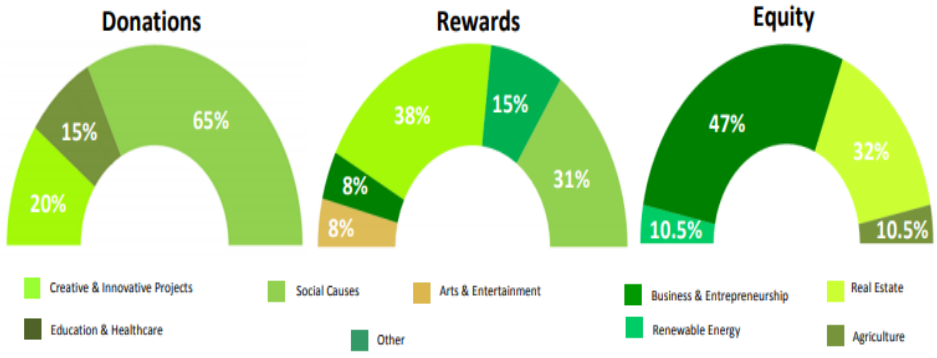


Some crowdfunding platforms that can be leveraged to enhance scientific research in developing countries offer specialized services to various sectors. For instance, the health research donation-based crowdfunding model credited for raising financial resources for non-profitable "health research that typically focuses on treatments for rare or neglected disease" and various platforms, such as, MyProjects, Consano, Cure Cancer Starter, and Experiment, have been involved in this regard.[133]

[132] Ibid
[133] Matthew J. Renwick, Elias Mossialos, "Crowdfunding our health: Economic risks and benefits," *Elsevier*, 191, (October 2017): 48. https://doi.org/10.1016/j.socscimed.2017.08.035.

Although the donation-based crowdfunding model is increasingly being leveraged to raise scientific research resources in Africa, as highlighted in Figure 8 below, other crowdfunding models are equally viable funding sources for investigative undertakings but apparently with varying degrees, and should be nurtured.

Figure 8. Breakdown of Africa-Based Crowdfunding Projects by Platform Model in 2015



Equity or investment-based crowdfunding has the capacity to fund "much larger projects as they present earning potential for funders."[134] In fact,

> *Pharmaceutical and biotech SMEs as well as spin-off companies from university research groups are using platforms such as Crowdcube and ShareIn to sell equity stakes in their company in return for capital .... This money may be used to accelerate clinical testing and development of a novel therapy, expand health service offerings, or scale-up pro-diction and operations for a medical product.*[135]

Whereas the reward-based crowdfunding model is a major fundraising aid for various creative projects and small businesses,[136] the model also supports scientific research endeavors. Regarding the potential benefits of the rewards-based approach to scientific research undertakings in Africa and other developing countries, it has been noted that.

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[134] Ibid
[135] Ibid
[136] Ibid

> *Many successful science-based crowdfunding projects have offered items such as photographs, t-shirts, or acknowledgement in published work. The goal of crowdfunding rewards is the opportunity to feel connected to science and the scientific process. Thus, rewards based on personal connections, such as frequent updates throughout the course of the research, guest lectures, dinners, or hosting donors in the field or laboratory for a day, also have great impact on contributors.*[137]

Another relevant crowdfunding insight that RAs and other scientific research stakeholders planning to undertake investigative projects beneficial to Africa and other developing countries need to appreciate is that unlike in traditional funding engagements, students and other junior investigators successfully leverage crowdfunding platforms more than senior investigators.[138] Therefore, enhancing crowdfunding initiatives will help address funding bottlenecks that junior investigators targeting traditional funding sources encounter. The fact that successful large-scale crowdfunding initiatives are generally moderately small, and women have relatively higher crowdfunding success rates compared to men is also noteworthy.[139]

Since junior investigators undertaking small scientific research projects dominate current crowdfunding initiatives, senior scientists may need to consider prioritizing larger scientific research crowdfunding engagements that will benefit Africa and other developing countries. After all, equity/investment-based crowdfunding has been identified as having capacity to fund "much larger projects."[140]

Reflections on crowdfunding dynamics underline the fact that fundraising for scientific research engagements in Africa and other developing countries may

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[137] Rachel Wheat et al., "Raising Money for Scientific Research Through Crowdfunding: Trends in ecology & evolution," *Cell Press*, (December 2012): 1- 2. https://www.researchgate.net/publication/233877496_Raising_Money_for_Scientific_Research_Through_Crowdfunding.
[138] Henrey Sauermann, Chiara Franzoni & Kourosh Shafi, "Crowdfunding scientific research: Descriptive insights and correlates of funding success." *PLOS ONE*, 14, (1). (January 2019). https://doi.org/10.1371/journal.pone.0208384.
[139] Ibid
[140] Ibid

significantly differ from requirements needed by conventional funding. In addition, since most crowdfunding initiatives generally raise relatively small scientific research project funds, implies crowd financing mechanisms cannot, in the interim, substitute conventional scientific research funding mediums but rather complement them.

There is need to investigate why prospects of junior scientific researchers like students and postdocs, particularly females, in undertaking successful crowdfunding initiatives are more than men and senior scientists. Is it because junior investigators are ambitious, have better capabilities to communicate using the internet, and is this the case in both developing and developed countries?

Before crowdfunding for investigative undertakings in Africa and other developing countries, there is also need for RAs and other scientific research stakeholders to appreciate that fundraising prospects of various crowdfunding platforms are directly related to the context within which the podiums operate. There is, therefore, a need to appropriately consider, for instance, the merits and demerits of using an Africa-based crowdfunding platform as opposed to using a crowdfunding platform based in HIC (or vice versa) for specific project undertakings in African countries.

Finally, it is also worth noting that crowdfunding initiatives that are beneficial to Africa mainly rely on external sources. It has been noted that,

> *Unlike other regions, where funding is locally driven by indigenous investors and platforms, crowdfunding in Africa has extensively been dominated by backers from outside of Africa. …. The growth curve and the dominance of foreign funds signal Africa's unexploited crowdfunding opportunities and the embryonic status of crowdfunding as a financing vehicle in Africa. These indicators may suggest several implications worth highlighting. First, there is a high possibility for the continent to continue to experience exponential growth. Second, a growing share of activities may emerge from within Africa as local platforms sprout, the populace gets better educated about and better familiarized with crowdfunding, and*

> *as regulatory institutions build legal frameworks that are more conducive and enabling of a crowdfunding ecosystem. Such developments are likely to increase indigenous backers' and investors' appetite towards crowdfunding local projects.*[141]

The fact that several successful crowdfunding endeavors in Africa are based on foreign backers is commendable and should be further nurtured. There is, however, also need to harness Africa's indigenous crowdfunding potential. This is important as it helps to reduce dependence on foreign backers who sometimes fail to adequately appreciate Africa's scientific research priorities and enhance sustainability.

6.2. Project Result 2. Crowdfunding Challenges in Developing Countries.

This Capstone Project has highlighted various crowdfunding benefits that enhance scientific research endeavors in Africa and other developing countries. However, there are also various challenges that need to be noted and addressed by RAs and scientific research stakeholders planning to undertake investigations in underdeveloped countries.

Crowdfunding challenges include the fact that there are sections of the public who are demotivated from crowd financing because investigative research projects do not necessarily provide physical outputs that could be "Pre-Sold" on crowd financing platforms. After all, "The products of science…are often immaterial."[142] Scientific research also produces outputs that are not as directly valuable as the case is for products from other types of projects. It is also worthwhile noting that investigative undertakings entail taking several risks, yet crowd funders tend to prefer projects whose success prospects are relatively high. Some potential crowd funders that can boost scientific

[141] Emmanuel Chao, et al., "Crowdfunding in Africa: Opportunities and Challenges." *Springer*, (August 2020): 333. https://doi.org/10.1007/978-3-030-46309-0_14.Pgs 321- 322

[142] Rachel Wheat & Yiwei Wang & Byrnes Jarrett &*Jai* Ranganathan, "Raising Money for Scientific Research Through Crowdfunding: Trends in ecology & evolution," *Cell Press*, (December 2012): 2. https://www.researchgate.net/publication/233877496_Raising_Money_for_Scientific_Research_Through_Crowdfunding.

research in Africa and other developing countries could also have misgivings that mobilized funds may be diverted hence the need for institutions that support crowdfunding to regulate the use of donated funds for compliance, accountability, and transparency purposes. RAs and other scientific research stakeholders need to undertake related effective outreaches targeting different crowd audiences in this regard. This is important since suspicions that funds raised by the crowd could be diverted,

> *…. raises the possibility of troublesome information irregularities between the project initiator, the crowdfunding platform and the backers. This is one of the potential weaknesses of crowdfunding platforms.* [143]

Crowdfunding legislation in Africa and several developing countries is currently inadequate. Title III of the JOBS Act[144] in the USA, for example, provides crowdfunding guidance and regulations, yet, in Africa, "Most crowdfunding platforms are currently operating out of any crowdfunding regulation unless they opted for a license as a financial service or a registered credit provider."[145] For instance, "there are no bespoke or specific regulations, or policies governing crowdfunding in East or South Africa."[146] This hampers the expansion of equity and debt-based crowdfunding platforms on the continent and in other developing countries that lack relevant crowdfunding regulations since prospective investors are reluctant to engage crowdfunding platforms that do not guarantee minimal investor protection rights.

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[143] Stéphane Onnée and Sophie Renault, "Crowdfunding: principles, trends and issues" ResearchGage, 13, no.5, (September, 2016): 313, https://www.researchgate.net/publication/308110904

[144] FINRA. n. d. Crowdfunding and the JOBS Act: What Investors Should Know," Accessed, October 28, 2020. https://www.finra.org/investors/alerts/crowdfunding-and-jobs-act.

[145] Edwige Boum, "Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms," *AfrikStart,* (2016): 20. http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf 40.

[146] Kieran Garvey, et al., *Crowdfunding in East Africa: Regulation and Policy for Market Development: Reducing Poverty Through Financial Sector Development*, (Cambridge, United Kingdom: University of Cambridge, January 2017): 12-13. file:///C:/Users/lmutesi1/Desktop/Lilian/School/CAPSTON/Resources/2017-05-eastafrica-crowdfunding-report.pdf.

The absence of adequate legislation can also result in members of the public crowdfunding for illegal and/or politically sensitive scientific research aspects in Africa and other developing countries. The lack of appropriate legal crowdfunding guidelines could also result in various other ethical and irresponsible research engagements that violate the Common Rule[147] and Institutional Review Boards' (IRBs) requirements on research involving human subjects, or violation of research regulations on lab animals.[148] In addition, scientific research ideas, once posted on crowd financing podiums, are susceptible to plagiarism, yet project authors may not have adequate legal backup to effectively address this. Scientific research requires rigorous Intellectual Property (IP) policies that protect researchers' work. For instance, it is potentially risky for scientific researchers if a crowdfunding platform, for example, requires investigators to provide sensitive project information before minimum patent rights are sufficiently guaranteed.

There are also concerns by the research community that if nonscientists determine research funding, quality control problems are likely to arise and that vital, yet complex or seemingly less attractive projects might also not be adequately funded.[149] Another challenge is that, it is not easy to determine the levels of crowd expectations for funded project outcomes. Moreover, their expectations may widely vary, thereby making it relatively hard to satisfy them all. Therefore, RAs and other scientific research stakeholders need to provide minimum standard implementation procedures and processes that ensure suitable mechanisms to monitor implementation and the appropriate

[147] Department of Health & Human Services, *Federal Policy for the Protection of Human Subjects ('Common Rule').* Accessed October 26, 2020, https://www.hhs.gov/ohrp/regulations-and-policy/regulations/common-rule/index.html
[148] Institute for Laboratory Animal Research. *Guide for the Care and Use of Laboratory Animals,* 8th ed, (Washington, D.C.: National Academies Press. Accessed on October 28, 2020. https://grants.nih.gov/grants/olaw/guide-for-the-care-and-use-of-laboratory-animals.pdf.
[149] Lucy Bennett, Bertha Chin, Bethan Jones, "Crowdfunding: A *New Media & Society* special issue," *SAGE Journals*, 17, no.2, (November 2014):1-6. https://doi.org/10.1177/1461444814558906.

use of funds are in place. This includes, among others, tracking project implementation, developing and disseminating progress reports.

The fact that crowd financing platforms circumvent conventional peer reviews and do not necessarily require investigators to demonstrate their prior research track records, such as the number of previous publications, may also result in unsuspecting crowds funding worthless scientific research campaigns. There is also a high likelihood that "Citizen" funders, in most cases, fail to comprehend and appreciate the quality and worth of proposed research undertakings. More so, if proposed, investigative undertakings targeting Africa and other developing countries seek to raise funds for those initiatives from foreign-based crowd funders.

Also, while crowdfunding may seem an alternative funding source, it may not necessarily be a solution for researchers who cannot meet high crowdfunding fees. Moreover, because successful crowdfunding projects are generally small, they may demotivate experienced senior researchers from participating, especially when expected financial rewards are not commensurate with their efforts. This should be a major concern for RAs and other scientific research crowdfunding stakeholders. There is need to address the lack of large-scale crowdfunded scientific research projects that arise from the fact that sizeable numbers of mobilized funders usually make small financial contributions.

In Africa, there is limited access to social media, there are inadequate funds transfer and payment mechanisms, and limited awareness on crowd financing, all of which hamper online scientific crowdfunding initiatives.[150] This has been worsened by

[150] Edwige Boum**, "**Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-Based Crowdfunding Platforms," *AfrikStart,(2016),* http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf

significantly low internet penetration, speed, and usage levels in many underdeveloped countries. The recent dramatic increase in mobile telephone penetration in Africa and other developing countries gives hope and needs to be leveraged to bridge this gap. Crowdfunding platforms such as M-Changa in Kenya have already started integrating mobile payments with crowdfunding engagements.[151] There is need to scale up crowdfunding promotional engagements on pertinent scientific research projects beneficial to Africa and other developing countries.

6.3. Project Result 3. Crowdfunding Best Practices Relevant for Scientific Research Enhancement in Africa and other Developing Countries.

There are several crowdfunding best practices that ought to be adopted to enhance scientific research undertakings relevant to Africa and other developing countries. This Capstone Project noted that successful fundraising depends on various crowd financing campaign aspects.

The driving/motivating factors for scientific research crowd funders are relatively different from backer's incentives in general-purpose crowdfunding platforms. Thus, while undertaking campaigns to mobilize financial resources for scientific research in Africa and other developing countries, it is ideal for RAs and other investigative stakeholders to identify specialized science crowd financing podiums that recognize this difference and institute measures that satisfy research backers'/funders' incentives. RAs and other scientific research stakeholders also need to identify crowdfunding podiums with the tools needed to meet their own (scientific researcher's) needs.

[151] World Bank Group. *Crowdfunding in Emerging Markets: Lessons from East African Startups.* World Bank, Washington, DC. (2015). https://openknowledge.worldbank.org/handle/10986/2382

Successful crowdfunding initiatives are also distinguished by the ability of crowd financing users (RAs and investigators) to mobilize their social networks since the larger the number of online social network friends, the higher the chances of success. It has been authoritatively noted, "…that strong social media use is critical to success in crowdfunding."[152]However, whereas most crowd financing initiatives initially require backing from networks of peers and relatives, there is need for scientific research stakeholders to mobilize critical crowd audiences/numbers in different parts of the world to back investigations in Africa and other developing countries. This necessitates substantial effort that could, among others, entail developing captivating lab notes and appropriately responding to issues raised by backers. This is critical considering that

> *The larger and more engaged the crowd surrounding a scientist's research, the more crowdfunding money that can be raised. As a consequence, science crowdfunding rewards scientists who have consistently reached out to audiences' overtime. Those scientists who do not spend time on outreach and engagement, however, may have a limited group of individuals from which to request donations.*[153]

It has also been noted that "campaigns with endorsements (15% of all campaigns) have significantly higher odds of success, and raise more funds than campaigns without endorsement."[154] In addition, "Campaigns that posted lab notes prior to closure (68% of all campaigns) have significantly higher odds of success and receive a higher volume of pledges than projects without lab notes."[155] Further, crowdfunding campaigns (58%) that make ideal fundraising video presentations that resonate with funder's contexts also tend

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[152] Habib Jamal, Sherwood Neiss, *Crowdfunding's Potential for the Developing World*, (Washington D.C.: info Dev/The World Bank, 2013), 8-12. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.
[153] Rachel Wheat et al., "Raising Money for Scientific Research Through Crowdfunding: Trends in ecology & evolution," *Cell Press*, (December 2012): 1-2. https://www.researchgate.net/publication/233877496_Raising_Money_for_Scientific_Research_Through_Crowdfunding.
[154] Henry Sauermann, Chiara Franzoni, Kourosh Shafi, "Crowdfunding scientific Research: Descriptive insights and correlates of funding success," *PLOS One*, (January, 2019):20/26. https://doi.org/10.1371/journal.pone.0208384.
[155] Ibid

to succeed. Successful crowdfunding projects also demonstrate from the onset of the ability to be qualitative and deliver promised goods.[156]

Identifying appropriate funding targets (backers/funders), recognizing the right time to engage them, and offering creative physical rewards that motivate scientific research funders are also crowdfunding best practices that should be emulated. Creative rewards can include, among others, opportunities to visit research projects or getting credited in upcoming publications. There is also need for RAs and other relevant scientific research stakeholders to ensure there is effective mobilization and appropriate engagement of potential crowd funders using effective mediums in efforts aimed at raising financial resources. This requires knowledgeable and skilled research communicators who can effectively engage targeted public audiences and explain scientific research issues whose relevance might not be apparent.

Thus, successful crowdfunding initiatives are based on the ability of scientific project initiators to fulfill obligations that are expected from them by funders. RAs and other scientific research stakeholders need to adequately appreciate the relevance of dedicated efforts such as preparing lab notes and other essential roles like identifying influential endorsers in various areas when undertaking scientific research crowdfunding campaigns that will benefit Africa and other developing countries.

Ideal steps for conducting successful scientific research crowdfunding in Africa and other developing countries, which RAs and other science stakeholders need to note, have been highlighted. When crowdfunding, it is important to note that before

> *...the campaign is formally published and open for money collection, fundraisers usually should engage in (1) campaign planning. During this*

[156] Ethan R. Mollick, "The Dynamics of Crowdfunding: An Exploratory Study" *Journal of Business Venturing*, 29, no.1 (January 2014): 1-16. http://dx.doi.org/10.1016/j.jbusvent.2013.06.005.

> *stage, the objectives and goals of the campaign are defined, different platforms are evaluated, ... campaign materials ... are prepared, promotional strategies are devised, and an execution plan with action points and deadlines can be outlined. Next, fundraisers engage in (2) campaign creation—where materials are uploaded to the selected platform, presence in social media is established (e.g. Facebook page, Instagram page, Twitter account, etc.), and initial feedback is collected from first pilot viewers. Lastly, the (3) campaign review takes place when the submitted materials are reviewed by platform operators, which ensures compliance with regulation, verification of fundraiser identity, and in some cases quality of the materials provided. When meeting requirements, the platform then approves the campaign for publication, its information is made publicly available, and the collection of funding is enabled.*[157]

Aspects highlighted 1-3 above give a clear glimpse of various crowdfunding tasks that RAs and other scientific research stakeholders need to indulge themselves in to successfully crowdfund for investigative undertakings in Africa and other developing countries. However, a complete crowdfunding process/campaign to facilitate successful investigative undertakings in Africa and other developing countries requires full engagement in activities included in aspects 4-7 highlighted below, which RAs and other scientific research stakeholders also need to engage in. These state that,

> *…once approved, the campaign is live and during a set period defined for the campaign, fundraisers engage in (4) campaign management which includes promotional efforts both offline and online, and especially via social media platforms, mobilization of network relations takes place, and new information and updates are gradually provided to fans and followers. At this stage, fundraisers need to focus on availability and responsiveness to comments, suggestions, and questions from the crowd for signaling trustworthiness as well as avoiding the loss of prospective contributors. In this sense, during this stage, the backers' decision- making process is both triggered and supported… (5) campaign results are finalized…. Finally, once the campaign is finished, a post-campaign stage unfolds. During this period fundraisers must first (6) deliver on campaign promises in sending promised products, services, or information…... Furthermore, the backers constitute a network of supporters the fundraisers can and should (7) develop further relations with. Such backers are assets that can be mobilized and tapped into in future activities.*[158]

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[158] Shneor Rotem, et al., "Introduction: From Fundamentals to Advances in Crowdfunding Research and Practice," *Springer,* (August, 2020):6-7. https://doi.org/10.1007/978-3-030-46309-0_1.

The World Bank notes that there is need to create crowdfunding knowledge networks for peer learning purposes.[159] The networks should be linked to Africa and other developing countries' scientific research crowdfunding policymakers and other stakeholders who currently work in isolation. Universities and other scientific research institutions undertaking or planning to undertake scientific research in Africa and other developing countries could create peer-learning communities through which they share crowdfunding investigative experiences and learn from each other. This could include sharing best practices to bolster scientific research undertakings relevant to developing countries and documenting results.

[159] Habib Jamal, Sherwood Neiss, Sherwood Neiss, "Crowdfunding's Potential for the Developing World," (Washington D.C.: info Dev/The World Bank, 2013): 10, 15, 19, 32. 33. https://www.academia.edu/30009658/Crowdfundings_Potential_for_the_Developing_World.

Chapter 7. Recommendations and Discussion

7.1. Introduction.

Chapter Seven (7) highlights measures that will enhance scientific research fundraising initiatives in Africa and other developing countries through crowdfunding. Identified measures will contribute towards the realization of Africa's development Agenda 2063: The Africa We Want,[160] other relevant developing countries' development initiatives and, ultimately, boost the realization of SDGs. There is need for HICs investigative stakeholders in IHE to collaborate with STEM and other investigative stakeholders in underdeveloped contexts in efforts aimed at enhancing scientific research crowdfunding in Africa and other developing countries. Since SDGs were adopted, "…higher education is more critical than ever…. The challenge is how to release the developmental potential of higher education, while avoiding the elitist disconnection from society that has characterized higher education in the past."[161]

7.2. Recommendations.

7.2.1. Recommendation 1. Enhance the Scientific Research Crowdfunding Theoretical Discourse in Africa and other Developing Countries.

- **Recommendation 7.2.1.1.** Investigators Need to Further Enrich Africa and other Developing Countries' Scientific Research's Crowdfunding Theoretical

[160] African Union, "Agenda 2026: The Africa We Want, a Shared Strategic Framework for Inclusive Growth and Sustainable Development," (Washington D.C.: *African Union*, 2015): 55, https://www.un.org/en/africa/osaa/pdf/au/agenda2063-first10yearimplementation.pdf

[161] Susy Ndaruhutse and Stephen Thompson, "Literature Review: Higher Education and Development," *REAL*. https://www.heart-resources.org/wp-content/uploads/2016/06/Literature-review-higher-education-and-development.pdf.

Discourse by Investigating and Documenting Emerging Dynamics. Researchers should Establish Why Junior Scientific Investigators Particularly Female, crowdfund more than Senior Researchers and whether Emerging Trends are Similar in both Developed and Underdeveloped Contexts. The Loan-Based Crowdfunding Model and its Implications on Scientific Research Undertakings in Africa and other Developing Countries also Needs to be investigated.

- **Recommendation 7.2.1.2.** Investigators Need to Vigorously Harness Indigenous and Sustainable Investigative Capabilities and Crowdfunding Potentials to Reduce Africa and Other Developing Countries' Dependence on Foreign Financial Support to Undertake Scientific Research.

7.2.2. Recommendation 2. Mitigate Crowdfunding Challenges in Developing Countries.

- **Recommendation 7.2.2.1.** RAs, Investigators, Policy Makers and other Scientific Research Stakeholders Need to Leverage Appropriate Technological Solutions that are Integrated with Existing ICT and Financial Infrastructure to Enhance Scientific Research Crowdfunding Undertakings in Africa and other Developing Countries.
- **Recommendation 7.2.2.2.**RAs, Investigators, Policy Makers, and other Scientific Research Stakeholders Need to Assure Crowd Backers/Funders that the Funds they Commit to Scientific Research Initiatives in Africa and other Developing Countries shall not be Diverted. Appropriate Awareness,

Accountability and Monitoring Measures Need to be Undertaken, as part of Minimum Standard Implementation Procedures and Processes.

- **Recommendation 7.2.2.3.** RAs, Investigators, Policy Makers, and other Scientific Research Stakeholders Need to Support the Development of a Conducive Crowdfunding Regulatory Framework in Africa. Self-regulation of the Crowdfunding Industry should be Promoted by Encouraging the Development of Appropriate Guidelines that Minimize Risks and Unethical Scientific Research Practices, while Creating an Enabling Environment for Growth, Innovation, Transparency, and Accountability.

7.2.3. Recommendation 3. Promote Crowdfunding Best Practices to Bolster Investigative Endeavors in Africa and other Developing Countries.

There are several crowdfunding best practices that should be adopted to enhance scientific research beneficial to Africa and other developing countries.

- **Recommendation 7.2.3.1.**RAs Need to Recognize and Interact with Major Crowdfunding Actors. RAs with Support from Scientific Investigators Need to Identify Dedicated and Specialized Science Based Crowdfunding Podiums with Essential Tools that Meet Scientific Researcher's Needs and those of Targeted Crowd Funders.
- **Recommendation 7.2.3.2.**RAsSupported by Scientific Investigators in Conjunction with Crowdfunding Platforms Need to Mobilize Influential Opinion Leaders, Social Media Experts and Bloggers, among others, to

Effectively Engage Local and International Audiences to Crowdfund Scientific Research Initiatives in Africa and other Developing Countries.

- **Recommendation 7.2.3.3.** Endorsements by Distinguished Scientists or Individuals during Crowd Financing Campaigns for Investigative Projects should be encouraged by Scientific Researchers with Support from Commissioned Crowdfunding Platforms and RAs.
- **Recommendation 7.2.3.4.** RAs in Conjunction with Commissioned Scientific Research Crowd Financing Platforms Need to Recognize the Relevance and also Harness the Power behind Peers and Relatives' Support Networks in Initiating Crowdfunding Campaigns while taking Appropriate Measures to ensure Larger Crowds are Mobilized and Leveraged to Raise Adequate Investigative Financial Resources Beneficial to Africa and other Developing Countries.
- **Recommendation 7.2.3.5.** RAs in Conjunction with Commissioned Scientific Research Crowdfunding Platforms Need to Identify Appropriate Funders/ Backers' Targets Recognizing the Right Time to Engage Them, and Offering Creative Physical Rewards that Motivate Scientific Research Backers (Funders).
- **Recommendation 7.2.3.6.** RAs also Need to Identify and Address Other Motivating Factors that Drive Crowdfunding in Support of Scientific Research Initiatives in Africa and other Developing countries.
- **Recommendation 7.2.3.7.** RAs, Investigators, and Other Relevant Scientific Research Stakeholders Need to Identify and Empower Competent

Communicators to Engage Public Audiences on Pertinent Investigative Research Aspects Involved in Crowdfunding Initiatives, especially on Issues that may not be Obvious. Crowdfunding Promotional Engagements such as Outreaches Targeting Various Audiences, Media Platforms; Informative Events, and/or Platforms Should Be Leveraged by RAs, Investigators and Other Relevant Scientific Research Crowdfunding Stakeholders to Garner Critical Public Support.

- **Recommendation 7.2.3.8.** Commitment and Hard Work in Preparing Crowdfunding Lab Notes, Identifying Competent and Influential Endorsers, Developing Fundraising Video Presentations, Among Others, is Required from RAs, Investigators, and Other Relevant Scientific Research Crowdfunding Stakeholders to Enhance Investigations in Africa and Other Developing Countries.
- **Recommendation 7.2.3.9.** Harnessing Specialized and Dedicated Foreign-Based Crowdfunding Platforms to Bolster Scientific Research in Developing Countries Remains Essential and Should Be Nurtured Further by RAs and Other Scientific Research Stakeholders. RAs Working in Africa and Other Developing Countries Particularly Need to Be Encouraged to Embrace Crowdfunding and Facilitate Its Use in Raising Required Scientific Research Resources.
- **Recommendation 7.2.3.10** Junior and Female Investigators Who Have a Crowdfunding Niche Should Leverage Crowdfunding to Bridge Funding Gaps

for Undertaking Scientific Research Beneficial to Africa and Other Developing Countries.

- **Recommendation 7.2.3.11.** Senior Investigators, Drawing on Their Knowledge and Expertise, Should Undertake Larger and Relatively Longer Scientific Research Crowdfunding Initiatives Beneficial to Africa and Other Developing Countries.
- **Recommendation 7.2.3.12.** International Scientific Research Crowdfunding Collaborations Involving IHE that are Beneficial to Africa and Other Developing Countries Should Be Established by Investigators, with Support from RAs and Other Investigative Crowdfunding Stakeholders.

Chapter 8. Conclusion

This Capstone Project has made it clear that leveraging the enormous potential of crowdfunding shall enable investigative stakeholders to effectively source scarce and much-needed funding from large and multifaceted audiences willing to back scientific research undertakings in Africa and other developing countries. This will enhance underdeveloped countries' efforts to effectively address scientific research funding barriers. Inadequate investigative funding has perpetuated underdevelopment characterized by abject poverty, pandemics, inadequate infrastructure, illiteracy, and a general shortage of knowledgeable, skilled, and effectual scientific research stakeholders in Africa and other developing countries.

Leveraging crowdfunding to bolster scientific research output and uptake will enable Africa to actualize its development plans titled Agenda 2063: The Africa We Want, while enhancing similar initiatives in other underdeveloped countries and ultimately contribute towards the realization of SDGs. This Capstone Project specifically enhances Africa and other developing countries' crowdfunding for scientific research theoretical discourse. Notably, the fact that since investigative research scholars have just started to realize that crowdfunding provides valuable scientific research support, there is a need for RAs and other scientific research stakeholders to be well-versed with critical crowdfunding dynamics that will enable them to effectively crowd finance for investigative undertakings in Africa and other developing countries.

To ensure investigative research stakeholders adequately grasp critical crowd financing dynamics necessary for boosting scientific research in Africa and other developing countries, this Capstone Project highlighted various crowdfunding financial

and non-financial benefits for investigative undertakings in underdeveloped contexts. Key crowd financing stakeholders who should be engaged, diverse crowd roles and motivations related to different crowdfunding models, and pertinent cultural dynamics were also highlighted. The value of transparency and accountability in scientific research crowdfunding endeavors, how cultural dynamics influence crowdfunding, the status and prospects of crowdfunding for scientific research in Africa, and other underdeveloped countries, were also highlighted.

This Capstone Project also noted that underdeveloped countries are not homogeneous due to differences and diversity of developmental levels, different institutional mechanisms, and several geographical factors that influence scientific research crowdfunding undertakings. Emerging crowdfunding-friendly ecosystems like better internet infrastructure and improved e-commerce mechanisms are noteworthy. They ought to be leveraged by scientific research stakeholders to bolster investigative undertakings in developed countries.

The need to nurture and harness indigenous crowdfunding platforms based in underdeveloped countries to enhance sustainable local fundraising efforts, particularly for critical scientific research undertakings that may not be sufficiently appreciated and prioritized by foreign backers, is paramount. There is also a need to continue rigorously leveraging specialized foreign-based crowdfunding platforms to bolster scientific research initiatives beneficial to developing countries while encouraging local efforts. Encouraging junior investigators generally, particularly female ones, who have a niche in crowdfunding undertakings, to prioritize investigative undertakings in Africa is critical.

So is the need to encourage senior scientists to support large-scale scientific research crowdfunded projects in underdeveloped countries.

This Capstone Project also highlighted crowdfunding challenges that need to be addressed and crowdfunding best practices that need to be replicated and/or scaled up in order to strengthen scientific research undertakings relevant for Africa and other developing countries. Challenges include the fact that scientific research projects often do not provide outputs that can be "Pre-Sold" on crowdfunding podiums and produce outputs, which are not as directly valuable as products from other projects. In addition, there are several risks in scientific research initiatives that minimize enthusiasm to crowdfund. Concerns among potential crowd funders on the possibility of mobilized investigative project funds getting diverted that hamper crowdfunding efforts were noted. This Capstone Project further highlighted that inadequate crowdfunding legislation in several underdeveloped countries hinders crowdfunding. This is because investors' rights are not protected, inadequate crowdfunding legislation is unable to check crowdfunded scientific research projects that are illegal or politically sensitive, and is also unable to bar plagiarism of investigative ideas posted on crowdfunding platforms.

Unsuspecting members of the public may also fund worthless investigative research projects that are not peer reviewed. In addition, members of the public may fail to appreciate the value of certain scientific research projects, moreover, most crowdfunded projects are small, which can also dissuade the involvement of senior researchers. This Capstone Project also showed that inadequate access to social media, funds transfer mechanisms, internet penetration, speed, and usage are major bottlenecks to crowdfunding initiatives in Africa and other developing countries.

This Capstone Project also highlighted remedial measures to identified scientific research crowdfunding challenges in Africa and other developing countries that RAs and other scientific research stakeholders need to consider. Public reservations regarding scientific research undertakings should be addressed through outreach and other essential promotional engagements. Meanwhile, improved mobile telephone access and use in several developing countries should be leveraged to address limited access to the internet and funds transfer apparatus.

Crowdfunding best practices that RAs and other scientific research stakeholders need to consider in order to improve scientific research in underdeveloped countries include the need to identify and leverage specialized and dedicated science-based crowdfunding platforms which use different crowdfunding models that can easily be accessed by targeted scientific research backers while also satisfying investigators' needs. Also highlighted is the need for scientific research stakeholders to mobilize and leverage social networks of friends and relatives as well as the wider public in initiating and sustaining crowdfunding campaigns.

It is ideal for scientific research crowdfunding campaigns to get endorsements from distinguished scientists and to engage influential people, including opinion leaders, social media experts, and bloggers, in efforts designed to enhance scientific research crowdfunding. It is also important for crowdfunding campaigns to post relevant laboratory notes before crowdfunding campaigns are closed and make fundraising video presentations relevant to crowd funder's contexts. Demonstrating the ability of proposed scientific research projects to meet minimum quality requirements and to deliver promised goods, services, or research results is commendable for scientific research crowdfunding

undertakings. Other best practices that need to be considered include the need to identify suitable crowd financing targets, the need to recognize the ideal time to engage crowd funders, and the need to consider offering public crowdfunding backers creative motivational scientific research rewards. The creation of knowledge networks to facilitate crowdfunding peer learning engagements involving relevant policymakers and other stakeholders is also commendable. It is also important for investigative stakeholders to have a comprehensive overview of critical steps required to conduct effective scientific research crowdfunding engagements that will enhance development.

This Capstone Project makes several recommendations that seek to strengthen scientific research undertakings beneficial to underdeveloped countries. Africa and other developing countries' theoretical discourse needs to be further improved by researching on various emerging issues. Crowdfunding's enormous potential in providing complementary scientific research financial and non-financial benefits needs to be vigorously tapped into. Harnessing foreign-based crowdfunding platforms while promoting indigenous crowdfunding initiatives is critical and commended. Junior investigators are encouraged to undertake small-scale scientific research crowdfunding initiatives beneficial to Africa and other developing counties, while senior investigators undertake large projects, females are particularly encouraged.

There is need to undertake outreaches and other scientific research crowdfunding promotional events where competent and skilled communicators promote investigative crowdfunding engagements relevant to Africa and other developing counties.

There is also a need to encourage the crowdfunding industry to self-regulate by developing relevant guidelines that address risks and unethical investigative practices. The

guidelines should endeavor to create enabling environments, which foster crowdfunding growth and innovation. The need to develop appropriate scientific research crowdfunding tools that enhance crowdfunding in developed and developed countries is essential. RAs and other scientific research stakeholders also need to consider adopting crowdfunding best practices highlighted by this Capstone Project, including the need for dedicated effort while undertaking crowdfunding campaigns and the need to identify endorsers, among others.

Finally, it is worthwhile noting that despite being a relatively new mechanism, the potential of crowdfunding in enhancing scientific research in Africa and other developing countries through various financial and non-financial benefits it offers, is huge and should be tapped into. There are several challenges that still need to be addressed, including the fact that since the phenomenon in Africa and other developing countries is just evolving, some crowdfunding practices may not be compatible with existing legal and policy frameworks.

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Appendices

Appendix 1. Crowdfunding Handbook for Research Administrators and other Scientific Research Stakeholders.

1.1. Overview of Scientific Research in Africa and Other Developing Countries and the need for Crowdfunding	Africa is contributing only 1-2% to global research initiatives.[162] Sub-Saharan Africa, whose population constitutes 13·5% of the world population, contributes below 1% of the global research output.[163]Shortfalls in sufficiently trained research leaders required to empower, guide, and increase investigative prospects for young African researchers have contributed to this predicament.[164] Other research barriers include insufficient funding, inadequate training facilities, and research motivation.[165] Limited research capacity gaps consequently "impede Africa's ability to effectively deal with the root causes of its deplorable state of health, unemployment, poverty, and other indices of development."[166]These challenges are not limited to Africa. For instance, *only 5–10% of all global health research funding is directed to research on health problems that affect 90% of the world's population, and only a small proportion of this funding actually goes to researchers in developing countries.*[167]" It has been rightly noted that; *funding from the crowd can expand the total amount of resources available for science, or at least partly compensate for tighter budgets of traditional funding agencies* This Handbook is, therefore, designed to enhance the capacity of Research Administrators and other scientific research stakeholders to leverage crowdfunding in efforts aimed at raising required scientific research financial resources beneficial to Africa and other developing countries. **Note:** This Handbook will be most useful to investigative stakeholders if it is studied and applied along with the Johns Hopkins University Capstone Project Titled: Guide for Leveraging Crowdfunding to Bridge Scientific Research Resource Gaps in Developing Countries: Descriptive Insights, Prospects and Challenges from Selected African Countries.
1.2. Crowdfunding Definition	***Crowdfunding*** *Crowdfunding is a new internet-based method of fundraising in which individuals solicit contributions for projects on specialized crowdfunding websites. The focus in crowdfunding is gathering many small donations (the 'crowd' in crowdfunding) rather than requesting a single large sum from a funding agency. Crowdfunding drives run over a limited timeframe, anywhere from a single day to*

[162] Lem Ngongalah, et al., "Research challenges in Africa – an exploratory study on the experiences and opinions of African researchers," *BioRxiv*, (October 2018): 1.0, 3.3, 3.1.4 – 3.2.3. https://doi.org/10.1101/446328.
[163]Sharon Fonn at al., (2018). Repositioning Africa in global knowledge production. The Lancet. 392. no. 10153, October 2018. https://doi.org/10.1016/S0140-6736(18)31068-7
[164] Isaac Olufadewa, Miracle Adesina, Toluwase Ayorinde, "From Africa to the World: Reimagining Africa's research capacity and culture in the global knowledge economy." *Journal of global health*, *10*. No.1, (June, 2020). doi: 10.7189/jogh.10.010321
[165]Lem Ngongalah, et al., "Research challenges in Africa – an exploratory study on the experiences and opinions of African researchers," *BioRxiv*, (October 2018): 1.0, 3.3, 3.1.4 – 3.2.3. https://doi.org/10.1101/446328.
[166] Isaac Olufadewa, Miracle Adesina, Toluwase Ayorinde, "From Africa to the World: Reimagining Africa's research capacity and culture in the global knowledge economy." *Journal of global health*, *10*. No.1, (June, 2020). doi: 10.7189/jogh.10.010321
[167]M Khan, Memon Zahid, ZulfiqarBhutta. "Challenges and Opportunities in Conducting Research in Developing Countries,"*Pediatric Epidemiology*, 21. (2018). https://doi.org/10.1159/000481323.

	several weeks, and attempt to meet a funding goal before the end of the campaign.[168] *Crowdfunding involves an open call, mostly through the Internet, for the provision of financial resources either in the form of donation or in exchange for the future product or some form of reward to support initiatives for specific purposes.*[169] *Crowdfunding can be defined as a collective effort of many individuals who network and pool their resources to support efforts initiated by other people or organizations. This is usually done via …. the Internet. Individual projects and businesses are financed with small contributions from a large number of individuals, allowing innovators, entrepreneurs and business owners to utilize their social networks to raise capital.*[170] Crowdfunding for scientific research is, therefore, the financing of investigative projects by raising numerous small amounts of money from large numbers of individuals using virtual platforms. It is the act of openly making funding calls by utilizing the internet as the main fundraising platform to facilitate investigative projects. The definitions above underline the fact that there is no standard crowdfunding definition.
1.3. Crowdfunding Types	***Crowdfunding Models*** ***1. Loan-Based Crowdfunding Model.*** *Loan-based crowdfunding is also referred to as peer-to-peer lending, whereby individuals/peers lend to other peers/borrowers via online electronic platforms.* *Debt-Based Crowdfunding is commonly referred to as Peer-to-Peer Lending. Investors give money to a business or any other project in exchange for financial return and/or interest at a future date. Investors are repaid for their investment over a period of time.*[171] The Loan-based crowdfunding model leverages online platforms to match lenders with borrowers who may include individuals, businesses, and other entities to enable them access loans. Lenders often obtain fixed-interest debts and require principal repayment based on mutually agreed upon schedules. Loan-based crowdfunding platforms may be preferred by entrepreneurs who do not wish to sell a stake in their business or projects. The model involves "secured and unsecured debt-based transactions between individuals/institutions and businesses with trading history.[172] ***2. Equity-Based Crowdfunding Model.*** *Equity crowdfunding is a form of financing in which entrepreneurs make an open call to sell a specified amount of equity- or bond-like shares in a company on the Internet, hoping to attract a large group of investors*[173]

[168] Rachel E Wheat, Yiwei Wang, Jarrett E Byrnes, Jai Ranganathan, "Raising Money for Scientific Research Through Crowdfunding," Trends in ecology & evolution, 28, no.2, (February 2013), https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1037.1424&rep=rep1&type=pdf

[169] Mokter Hossain and Gospel Onyema Operaocha, "Crowdfunding: Motives, Definitions, Typology and Ethical Challenges," Entrepreneurship Research Journal, 7, no.2, (December 2016).https://doi.org/10.1515/erj-2015-0045

[170] Ibid

[171] Edwige Boum, "Crowdfunding in Africa: Fundraising Goes Digital in Africa – The Emergence of Africa-based Crowdfunding Platforms," *AfrikStart*, (2016), 65.http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf

[172] Kieran Garvey, et al., *Crowdfunding in East Africa: Regulation and Policy for Market Development: Reducing Poverty Through Financial Sector Development*, (Cambridge,United Kingdom: University of Cambridge, January 2017): 12-13. https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2017-05-eastafrica-crowdfunding-report.pdf

[173] Ahlers Gerrit K.C., Douglas Cumming, Christina Günther,"Signaling in Equity Crowdfunding," *SAGE Journals*, 39. no.4 (July 2015): 955-958. https://doi.org/10.1111/etap.12157.

Equity-based crowdfunding allows investors to become part-owners of the company raising money by trading capital for equity shares. Investors are entitled to receive financial return for their investment and a share of their profit (dividend and distribution).[174]

Equity-based crowdfunding is a model whereby funders expect a financial return on their investment. It is also referred as a profit-sharing model. In this model, entrepreneurs urge people to invest money in order to receive a share of the venture's future earnings.[175]

Funders under the equity crowdfunding model, therefore, do so with the expectation of receiving shares (equity) after profits have been realized by the scientific research project or to receive some other form of recognition. The equity or investment-based crowdfunding model has the capacity to fund "much larger projects as they present earning potential for funders."[176] In the health sector,

Pharmaceutical and biotech SMEs as well as spin-off companies from university research groups are using platforms such as Crowdcube and ShareIn to sell equity stakes in their company in return for capital …. This money may be used to accelerate clinical testing and development of a novel therapy, expand health service offerings, or scale-up pro-diction and operations for a medical product.[177]

3. Donation-Based Crowdfunding Model.

Donation-based crowdfunding is the simplest and most popular type of crowdfunding. In this model, funders donate for philanthropic purposes. These donations are usually made to social and charitable initiatives, with funders not expecting a return on their investment … Donations can also be made to profit-oriented enterprises, but pure-donation platforms are uncommon and generally focus on requests from charities and nonprofit organizations …. Funders generally donate to a cause they believe in…. Naturally, the risk associated with donation-based crowdfunding is very low, because there is no obligation for founders to provide a return, nor do the funders expect one.[178]

Donations-based crowdfunding allows individuals (donors) to send money to people (or projects) in need (beneficiaries), with no financial (return) consideration in exchange for their money. This form of crowdfunding is used primarily in the nonprofit sector to support various causes[179]

Thus, for the purpose of this Handbook, donations-based crowdfunding involves individuals giving or donating funds for a particular scientific research cause without having financial or other expectations except for the satisfaction of being part of a worthwhile investigative cause. The model is credited to be ideal for research and creative project undertakings.[180]

4. Reward-Based Crowdfunding Model.

[174]Ibid
[175]Mokter Hossain and Gospel Onyema Operaocha, "Crowdfunding: Motives, Definitions, Typology and Ethical Challenges," *Enterpreneurship Research Journal*, 7, no.2, (December 2016), https://doi.org/10.1515/erj-2015-0045
[176]Ibid
[177] Ibid
[178]Ibid
[179]Ivo Jenik, Timothy Lyman, & Alessandro Nava, *Crowdfunding and Financial Inclusion*. *CGAP*, Washington D.C., March 2017. https://www.cgap.org/sites/default/files/Working-Paper-Crowdfunding-and-Financial-Inclusion-Mar-2017.pdf
[180]Natasha Chopp, Patience G. Condellone, and Jerry B. Weinberg, "Crowdfunding: Navigating the New Frontier in Research Funding and Administration," *NCURA*, XLV, no.5, (October/November 2013): 32-34

Reward-based crowdfunding provides funders with a non-monetary return, such as one of the first manufactured products. In this model, entrepreneurs invite potential customers to pre-order their product offering, sometimes at a lower-than-usual price. Founders may also offer gifts and other non-monetary rewards to their funders, but they never pay interest or a share of their business earnings."[181]

reward-based' crowdfunding involves the founder offering material incentives to funders based on the value of their contributions, with items such as t-shirts, baseball caps and thank-you notes offered in return for smaller contributions. Larger contributions are rewarded with a wide range of more desirable and prestigious incentives, which might include a walk-on part in a movie or tickets to an exclusive launch party. Often, the reward structure for a crowdfunding campaign also involves some degree of pre-selling; founders may reward some contributions by providing the funder with early access to the product or service being produced using the funds raised by the campaign.[182]

Under the reward-based crowdfunding model, funders who back a particular scientific research cause receive a small reward as a result of their contribution towards an investigative cause.

1.4. Crowdfunding Dynamics

Figure I below highlights critical characteristics of different crowdfunding models that should be leveraged to enhance scientific research in Africa and other developing countries.

Figure i. Crowdfunding Models[183]

Crowdfunding Model	Characteristics
Donations	• Often used for charitable goals; • Campaigns typically attract < $10,000 in funding; • Campaigns can be set up rapidly; • Used globally.
Rewards	• Often used by early-stage entrepreneurs; • Campaigns typically attract < $1m in funding; • Allows entrepreneurs to market-test ideas and market product; • Shipping rewards is logistically difficult; • Used primarily in middle-and high-income countries.
Lending	• Used for personal and business loans; • Campaigns typically attract < $500,000 in funding; • Fast application process; • Used globally.
Equity	• Often used by start-ups; • Campaigns typically attract < $5m in funding; • Risky, but allows individuals to invest in potentially high growth companies; • Used primarily in middle- and high-income countries.

[181] Ibid
[182] Joe Cox, and Thang Nguyen, "Does the crowd mean business? An analysis of reward-based crowdfunding as a source of finance for start-ups and small businesses," *Journal of Small Business and Enterprise Development*, (November 2017): 5, https://www.researchgate.net/publication/321213987_Does_the_crowd_mean_business_An_analysis_of_reward-based_crowdfunding_as_a_source_of_finance_for_start-ups_and_small_businesses
[183] AlliedCrowd, "East Africa Crowdfunding Landscape Study,"*FSDAfrica*, October 2016, https://www.fsdafrica.org/wp-content/uploads/2019/08/16-11-07-Crowdfunding_Report-final-1-compressed.pdf

Figure II below provides other essential crowdfunding insights that are useful in guiding Research Administrators (RAs) and other Scientific Research Stakeholders while undertaking investigative initiatives beneficial to Africa and other developing countries.

Figure ii. A Proposed Typology for Crowdfunding.

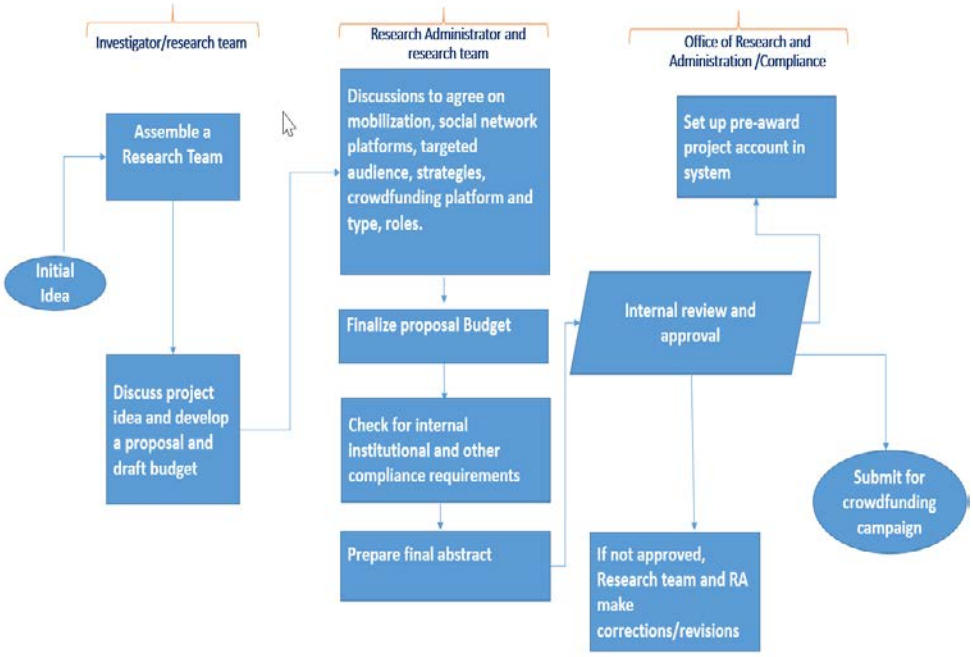
Type	Donation-based crowdfunding	Reward-based crowdfunding	Equity-based crowdfunding	Lending-based crowdfunding
Motivation of funder	Intrinsic and social	Intrinsic, social and extrinsic	Financial gain	Social and/or financial
Type of contribution	Donation	Pre-order	Investment	Loan
Expected return of funder	Intangible benefits	Tangible and intangible benefits	Return on investment	Return on investment
Motivation of funder	Intrinsic and social	Intrinsic, social and extrinsic	Financial gain	Social and/or financial
Main focus	Journalism/worthy cause/philanthropy	Products for early adopters/gifts	Start-ups	Short-term borrower
Complexity of process	Very low	Low	High	Medium
Example primary beneficiaries	Project owner(s), musicians, non-profit entities	Start-ups, funders	Start-ups	Individuals, business entities
Type of contract	A contract without existential reward	Purchase contract	Shareholding contract	Lending contract

1.5. Crowdfunding in Africa and Other Developing Countries: Research Administrators and Senior Scientists' Roles

Outline of Research Administrator's Crowdfunding Roles

1. Discuss and appreciate nitty-gritty crowdfunding scientific research project aspects, including pertinent roles and responsibilities with relevant research teams; Investigators, Research Administrators, and other scientific research financing stakeholders like crowd financing podiums.
2. Appreciate and adhere to critical crowdfunding timelines, particularly pre- and post-submission timelines. This underscores the need to ensure appropriate scientific research abstracts and projected budget preparations, internal reviews, and pre-submission approvals, and implementation, among others, are conducted in time.
3. Identify appropriate crowdfunding platforms/podiums. Consider ranking/popularity, legitimacy, accessibility, nature of crowdfunded projects and targeted donors, review track record of past successful investigative projects, the driving/motivating factors, cultural dynamics, compatibility, adaptability, and associated risks.
4. Assess and determine the right crowdfunding type/mechanism for the investigative project; Donations/Reward/Equity/Debt. Relatively small scientific research projects in the range of about $10,000 may, for instance, benefit from leveraging donation-based crowdfunding platforms, while relatively large investigative research projects that require funding worth $5 million and above would probably be more ideal leveraging equity-based crowdfunding platforms.
5. It is ideal to identify and leverage specialized science crowd financing podiums with a global outreach.
6. Work with the research teams to develop appropriate project budgets and necessary briefs targeting the public.
7. Support the identification and turning around of scientific research crowdfunding challenges into strengths. For example, technological and other scientific knowledge challenges can be turned around by identifying and using specialized scientific

	crowdfunding platforms with the capacity to effectively mobilize and engage targeted audiences/funders in different jurisdictions. RAs can also identify and leverage the expertise of experienced and knowledgeable scientific research project investigators in different jurisdictions to address identified knowledge gaps amongst some crowdfunding platforms. 8. Establish and nurture institutional research collaborations for certain scientific research projects in Africa and other developing countries. This will facilitate the identification of appropriate investigative priorities beneficial to Africa and other developing countries. 9. With support from relevant scientific research teams and crowdfunding platforms, partner with relevant financial and ICT actors on a case by case basis to enhance crowdfunding initiatives in Africa and other developing countries. This is particularly in countries that have relatively limited access to the internet and relevant crowdfunding financial infrastructure. 10. Actively participate in crowdfunding platform campaigns and engage with other relevant scientific research stakeholders to identify relevant target audiences required to facilitate mobilization of investigative research resources. For example, friends and relatives, members of the diaspora as well as other local and international audiences. 11. Establish robust communication and outreach mechanisms to attract large and appropriate crowd financial backers. For example, appropriate social media networks, influential local opinion leaders, social media experts, bloggers, and distinguished scientific actors should be leveraged to effectively mobilize crowds to financially back scientific research projects beneficial to Africa and other developing countries. 12. Check adherence to internal and other relevant scientific research compliance requirements. This, among others, necessitates engaging key institutions that oversee compliance requirements, such as federal and internal institutional regulations, which include Intellectual Property Rights, and IRB, among others. 13. Support the establishment of appropriate implementation and reporting mechanisms, including relevant institutional policies, international scientific research collaboration agreements, among others, to guide overall implementation and reporting. 14. Get acquainted with, and where applicable, participate in critical crowdfunding processes/procedures that have been adequately highlighted on pages 55-56 of the Capstone Project. **Outline of Senior Scientists' Crowdfunding Roles** 1. Develop appropriate scientific research idea (s) beneficial to Africa and/or other developing countries. 2. Establish and support critical international scientific research collaborations that entail crowdfunding beneficial to Africa and other developing countries. 3. Identify and support appropriate investigative research teams. This may include scientists/collaborators, research administrators, institutional colleagues, research/project mentorship teams (if needed, for example, for Postdocs), consultants, etc. 4. Work with constituted research team(s) to develop/build on the research idea(s) and project budget, among other pertinent issues. 5. Get aquatinted with identified crowdfunding platforms to determine their adequacy for scientific research undertakings beneficial to Africa and/or other developing countries. 6. Technically support campaigns on identified crowd financing platforms. For example, availing relevant technical briefs such as lab notes and answering questions from the public regarding critical scientific research project related questions. 7. Comply with institutional policies for internal review prior to project submission 8. Oversee and ensure there is adherence to critical scientific research project crowdfunding standards, milestones, and timelines.

	9. Oversee the establishment of appropriate implementation and reporting mechanisms, including relevant institutional policies, international scientific research collaboration agreements, among others, to guide overall implementation and reporting. Figure III below is an overview of RAs and senior scientists' roles and responsibilities in crowdfunding for scientific research initiatives beneficial to Africa and other developing countries. **Figure iii. Overview of Research Administrators and Senior Scientists' Crowdfunding Roles** 

Appendix 2. Short Biography.

Lilian Mutesi Oonyu holds a Bachelor in Administration and a Master of Arts in Public Administration, both degrees obtained from Makerere University Kampala, Uganda. She is currently a Financial Analyst, University Student Services, Johns Hopkins University (JHU). She has over eight years' experience working with federal and private foundations, including NIH, NSF, the World Bank Bill, and Gates Foundation. She has also worked with the Joint United Nations Program on HIV/AIDS (UNAIDS) in Uganda as Head of Administration, that entailed working with the Uganda Government, UN Bilateral sponsors in Uganda; DFID, Irish Aid, USAID, and with the UN Family, under the Joint HIV/AIDS Program in Uganda.

While at the JHU Rakai Office, she worked with several investigators in the US and their collaborators across the world. She coordinated contractual, administrative, regulatory, financial, and technical aspects of the program. This included liaising with Program Collaborators in the US, Canada, United Kingdom, and Uganda, and with NIH Program Officers in the US on administrative matters. Notably, she supported the D43TW009578 NIH Fogarty grant by Principal Investigator Dr. Ronald Gray, titled: "Male Circumcision and Use of Foreskin Tissues for HIV Prevention in Uganda." Tasks included budget development and management, implementation follow-up, and development of preliminary reports for the Principal Investigator, for final submission to the sponsor. In her current position, she has been privileged to set up financial systems for over 400 University student organizations. This entailed coordinating the development of a Finance Manual/Guide designed to enhance access to financial

resources by student organizations by leveraging current JHU systems, procedures, information, and guidelines.

Lilian's passion as a Finance and Research Administrator continues to grow. She is enthusiastic about becoming a lifelong learner. She yearns to enhance her intellectual self-actualization ability and decision-making knowledge and skills to probe and address specific scientific research administration problems.